# Electrical World

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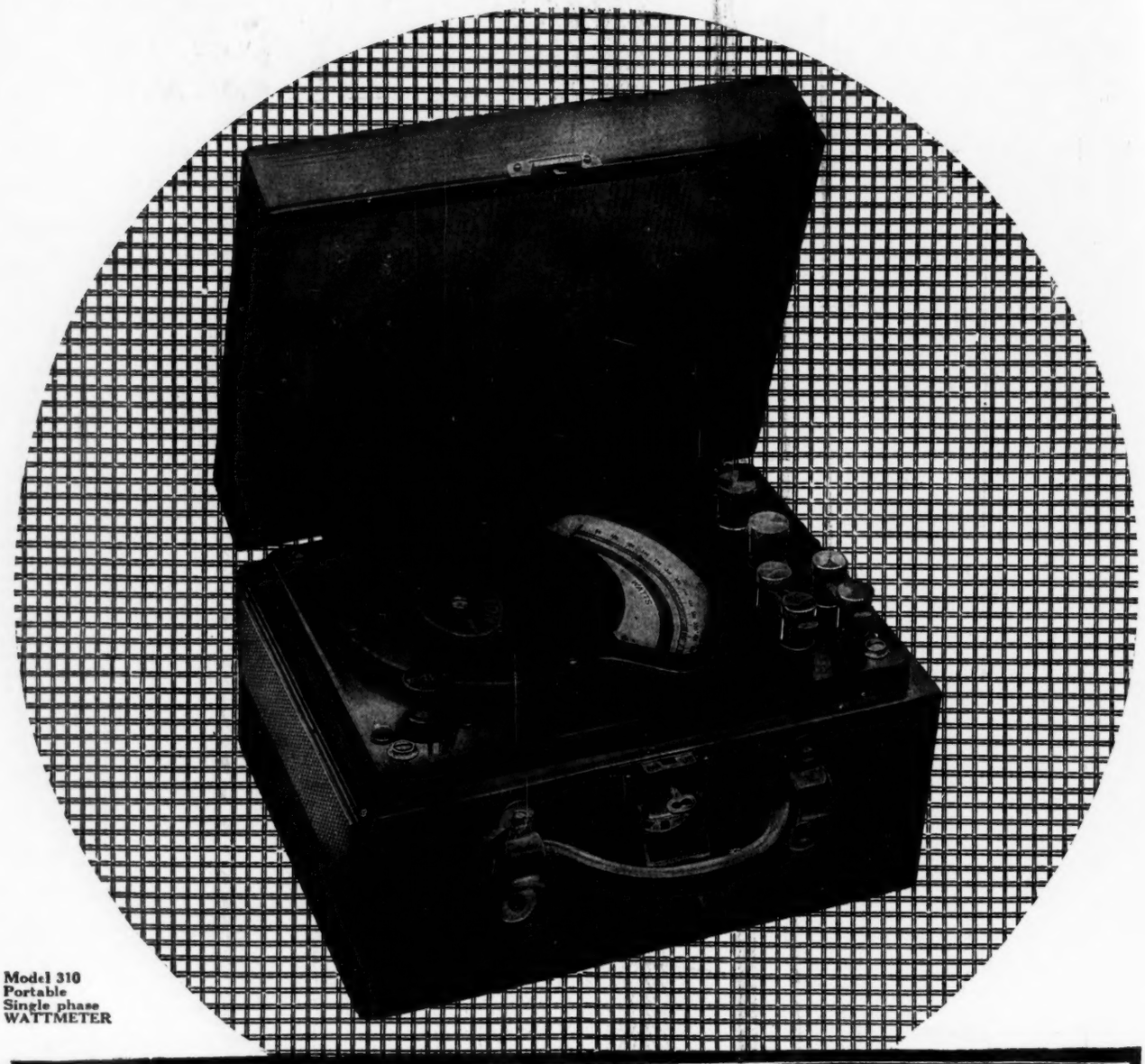

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# Electrical World

*The consolidation of* ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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## Loss to Engineering

MODERN engineering achievement can scarcely be traced to any one man, being usually the contribution of many minds working along similar lines. When, therefore, one engineer stands out preëminently among his fellows he is entitled to recognition as a master. Such indeed was Frederick Sargent, whose death we record in our news pages this week. A genius in the design and operation of steam electric generating stations, he has left his imprint indelibly on the central-station industry of his day and generation. Few, if any, have contributed more to the economy and perfection of electric public utility work and to the ideals of service which underlie and sustain that work. To his skill as a designer many magnificent stations bear striking tribute. Indeed, they are fitting monuments to his memory to which other engineers may turn for inspiration and guidance. Those who knew him best, who intrusted him with pioneer work involving millions of dollars, and who in the completion of that work saw their faith and his skill vindicated, bear striking testimony to his worth. Mr. Insull's tribute, colored and heightened though it may be because of a life-long friendship with Mr. Sargent, is not wide of the mark. The industry has indeed suffered a great loss.

*Electricity is still intangible to the great mass of people. The utility company which serves the community, however, is full of events of human interest to the public. A live publicity man will find them.*

## Proposed Changes in A. I. E. E. Activities

THE proposals of the development committee of the American Institute of Electrical Engineers, as reported at the recent Lake Placid convention, formed the subject of much discussion there. There can be nothing but commendation for the aims of this committee toward increasing the influence and utility of the A. I. E. E., and it is evident that as time goes on changes are needed in the policy of the Institute in order to meet the changed conditions which time brings. Nevertheless, radical changes in policy should only be introduced with great care and after a most painstaking survey, because it is easily possible to undo in a few months by injudicious procedure the constructive work of many preceding years.

The A. I. E. E. is essentially a professional body, and the dignity of the electrical engineering profession is committed to its keeping. Consequently, policies which would be perfectly proper in the conduct of commercial bodies might be entirely improper for it to pursue. Extensive and blindfold solicitation of advertisements, for instance, might be regarded with the pride of zeal by an industrial corporation, but might be fraught with the most unfortunate consequences in a professional organization, where achievement, and not dividends, is the goal.

There is, in our opinion, great danger in the proposal to substitute an engineering periodical for the present monthly *Proceedings* of the A. I. E. E. In so far as the proposal seeks to popularize the publications of the Institute it is pernicious and objectionable. A popular monthly magazine would degrade the Institute every succeeding month that it appeared. Engineers do not want to be amused when they turn to the pages of their professional journal. They seek instruction and reliable engineering information. If it is contended that such information, as at present offered, is hard to understand, the criticism applies to the writers of the papers and not to the character of the literature. Moreover, beyond a certain limit in lucid presentation, applied science can go no further toward the engagement of understanding. Knowledge is worthy of effort in acquisition, and to learning there is no royal road. Those who complain about the difficulty of reading engineering literature merely endeavor to shift from their own shoulders the responsibility of not studying. In all probability they would not learn under any guise of presentation.

The task of the Institute is to publish and circulate the highest, best, most recent and most useful literature in electrical engineering. There is no other body to compete in that task on the whole American continent. It cannot do that task too well.

*Opportunity may knock once at every man's door, but it has been knocking at the door of the electrical industry to point to new openings for many years and it is not through yet.*

## Standard Rates for Municipal Lighting

THE termination of a public lighting contract affords a pretext for political agitation which is sometimes exploited to the limit by office holders or place seekers caring little about the reasonableness of the rates involved. For many companies the negotiation of a new contract of the above kind becomes a task of considerable difficulty owing to popular misconceptions of the profits derived from this class of service. Even in a community where excellent relations are maintained between the people and their utilities, the average central-station manager sighs with relief when the public lighting agreement is concluded for a term of years long enough to enable him to devote major attention to the problems of commercial service and development. This does not mean that his rates or practices are vul-

nerable, but that the burdens of trying to satisfy the diverse interests represented in a contract with the public authorities are often unduly complex and exacting.

The establishment of standard rates for municipal lighting deserves serious consideration. This practice reaches its complete development in a schedule which may be applied without discrimination to every city and town reached by a central-station system. Such a tariff may be incorporated in the regular rate sheet or folder, so that the cost of street lighting or of public building service to any community is readily determined from it. The unit rate, for example, may apply throughout the territory in the form of a fixed charge and a running charge per lamp, an arrangement which greatly simplifies the negotiation of contracts in different places reached by the same company. In some cases a standard rate per lamp per year, with a stated number of hours of burning, may be used without the subdivision of the price; but whatever the form of the unit price, a standard applicable to similar conditions so as to produce similar bills is mutually beneficial to both the public and the company. It ought to be unnecessary to have to "dicker" over street-lighting rates once a fair rate base for a district is established, although the contract should properly carry a provision for revision through arbitration or otherwise at reasonable intervals.

*Pittsburgh is an illustration of a city which expects to hold its war-time growth. Witness the forehanded policy of its electric light and power company in raising $25,000,000 for additions to the system. Courage and faith!*

## Some Practical Advantages of Y-Connection

THE distribution of transmitted power to small and scattered communities is a rather severe economic problem which has to be faced not infrequently and sometimes drives the constructor to unusual methods. A very good example of what can be done in this line was described in last week's issue by A. V. Taylor with respect to the practice of the Ottertail Power Company, which serves forty towns and villages in Minnesota and the Dakotas.

To simplify construction three standard types of outdoor substation have been adopted on the system, connected in Y, with all neutrals at both generating and receiving ends solidly grounded. There is, therefore, but one high-voltage lead to each single-phase transformer. The other terminal being grounded in Y-connection, its lead wire is carried uninsulated to the overhead ground wire, itself grounded at every transmission pole. This furnishes a complete and perfectly grounded neutral, a good lightning-arrester ground for instruments installed at the substations, and incidentally the ground wire has proved to be an addition by no means inefficient to the lightning protection. At the larger substations full three-phase Y-connections are installed; at the smaller ones two transformers in open Y or single-phase distribution. At the substations a choke coil and combined disconnecting switch and expulsion fuse are used on the high-voltage side, and the low-voltage side is protected by choke coils and multigap lightning arresters. The fuse and metering equipment is installed in a metal-lined wooden box. The larger substations are provided with electrolytic arresters on suitable foundations.

At every main junction point on the loop which forms the main circuit line sectionalizing switches are installed on both sides. These are of the air-break type and so arranged that they can be securely locked in either the shut or open position by a padlock on the operating handle. The system thus formed is of rudimentary simplicity and appears to have worked out very well in practice. The voltages carried are not high, an ample factor of safety can be provided in the insulators, and there seems to be no reason why the construction cannot be freely used in cases where considerable distance must be covered and economy is imperative. The three-phase, four-wire system has numerous good points in its favor for many uses, and the one here described is worth serious consideration in a good many small transmission plants, particularly in regions where the risk of grounding from trees is not considerable.

*When we speak of the commercial opportunities of the central station we see long vistas of developed industrial, residential and public utility applications. But the immediate business in hand is that of getting the load still within fingers' reach which has not yet been put in the record of customers.*

## Electric Furnace Performance

WE ADD this week to our recently published notes on electric furnace work a short paper by W. K. Booth discussing in some detail the actual effects of furnace operation, and particularly starting up, upon the load demanded in the circuit. The operation of an electric steel furnace of the ordinary character is, from the energy standpoint, rather violent. In the beginning, when the electrodes are brought down upon the charge of scrap, short-circuit conditions may be established instantly, depending in character upon the contact resistance of the charge together with the reactance of the leads and circuit. Sometimes it is difficult to strike an arc at all, while another character of charge will start off with a formidable short circuit. As the operation continues there is a gradual melting down of the scrap, lowering the resistance, while the formation of pools of molten metal varied by the tumbling of the charge as it melts changes it in a very erratic manner. There may be therefore a series of severe fluctuations of load, which usually subside after a half hour or so when the conditions in the charge are becoming more steady.

The extent of these fluctuations depends on the power factor of the furnace and its transformers, the operating voltage and the character of the scrap being melted, the last-named being a variable of a most erratic character. Inasmuch as an electric furnace is generally to be used for melting all sorts of scrap material, the supply of energy must be carefully considered if the load is not to produce trouble on the circuits. Before putting such a plant into operation a survey of the power conditions ought to be made, bearing in mind the generating capacity of the supply station, the feeder circuits of the furnace supply, including their resistance and reactance, and the relations of other connected loads to the supply system. Thorough inspection of the situation preliminary to establishing service often results in saving considerable expense later in adjusting the supply conditions to the load which is taken on. It also may be of material advantage to the

user of the furnace in placing his order for equipment. The whole story is that from the very nature of the operation an electric steel furnace has periods of great instability of load, quite irrespective of its average demand, and that consequently it requires much care and foresight lest the fluctuations both interfere seriously with the furnace performance and disturb other power consumers on the distribution system.

*Match manufacturers used to say that business was certain to be active because people smoked and lighted fires whether times were good or hard. In the electrical industry we are in the habit of looking for great growth over a period of years with few if any reactions owing to seasonal variation in general business conditions.*

## A Hydroelectric Emergency Plant

IT GENERALLY happens that in any hydroelectric system one or more steam plants find place as auxiliaries to help carry the peak or to serve as a reserve in sudden demands for power. Our readers will be interested in a reserve station of a different kind recently installed at Rice Rips, Me. This station is really a hydroelectric development for emergency purposes, the system to which it is connected having two other developments on the same stream for regular service. The Rice Rips situation from the hydraulic standpoint is a somewhat peculiar one. The drainage area is comparatively small but has an exceptionally good storage in the Belgrade Lakes, covering an area of about 28 square miles (7250 hectares). The net head available at Rice Rips is 39 feet (11.9 m.). The dam is of reinforced cellular structure with cut-off wall of sheet-steel piling, and water is taken from the headworks to the power house in a 10-foot (3-m.) wood-stave penstock.

An unusual feature of the headworks is a reinforced-concrete headgate 12 feet (3.7 m.) square and operated by chain hoists. The penstock is Oregon fir, kyanized, laid in an open cut with the curves of shorter radius made of reinforced concrete. This furnishes a durable and cheap construction well suited to the purposes of the plant. At the power house the headgates are motor-operated, but of reinforced concrete as at the other end of the line. The single vertical-shaft turbine is installed in a concrete spiral flume and regulated at the switchboard. The ordinary draft tube is replaced by the "hydraucone" construction, which made it possible to drop the power-house floor considerably and get a higher efficiency guarantee from the wheel makers. The generator is a single-unit vertical-shaft 2000-kva. machine operated at 150 r.p.m. with the exciter on the upper end of the generator shaft. The leads from this generator pass to an out-door step-up station raising the voltage from 2300 to 33,000. The transmission is comparatively short. One line at the lower voltage runs to one of the stations on the same stream; another is a tie line connecting to one of the trunk lines of the Central Maine system fed from other streams. The overhead structure is of cedar poles spaced at about 200 feet (60 m.), and the line itself is of steel-reinforced aluminum cables. The interesting feature of the plant is the comparatively low cost, considering the head, and the fact that the small installation was carried out in war times under priority orders as it was intended to back up the power supply to important shipbuilding plants at Bath. The whole cost was only $158 per kva.

## Cheap Interior Wiring

A RECENT discussion reported in the London *Electrician* deals with a problem which is just now becoming extremely important in our own country; that is, the wiring of buildings, especially dwelling houses, at a moderate cost. At the present time the conventional methods of wiring lead to installation figures so high as to form a serious addition to the general expenses, already enormously increased. The requirements of the underwriters have gradually become more severe, and practice has therefore turned to the use of somewhat elaborate conduit systems, relatively costly even in pre-war days, and doubly so with present rates for labor and material. The cost of any interior wiring depends first on the cost of labor, second on that of insulated conductors, and third on the accessories, such as conduits, switches, fuses and the like. The labor costs have gone up probably to stay, and relief in the total must lie in the two latter items. Simpler and cheaper methods are highly desirable if they can be carried out without material increase in the risks. There have been repeated attempts to introduce in this country the concentric wiring which has been utilized abroad, but they have not met a very cordial reception.

Looking at the matter broadly, it is quite certain that our wiring methods require far greater expenditure than has been common in foreign installations. The wiring, for example, in many foreign hotels is of a character to throw an underwriter's inspector used to American practice into cold shivers, although we very much doubt whether the records abroad would show actual risks which would have to be taken seriously. One of the interesting suggestions brought out in the discussion which serves as the text for this comment was for the use of a very simple unarmored twin-conductor cable, substantially a large rubber cord in which two conductors are completely embedded and definitely spaced apart by longitudinal strips. Experiments show good results mechanically and electrically from such construction, and it certainly has the merit of being extremely easy to run and very simple in the details of installation, provided the proper appliances are at hand. Whatever the merits of the construction as compared with concentric wiring, it is certainly a step toward the simplicity which is necessary if wiring costs are to be kept down. This, like all other plans for reducing total costs of labor and material, deserves at least careful investigation on a considerable scale. The faults of some of the earlier, cheap methods of running wires were due more to careless workmanship than to inherent characteristics, and many of the severe regulations which have grown up are due not so much to real need as to shabby work done by a few indifferent contractors and to laxness on the part of inspectors. The public does not deserve punishment on account of the sins of either of these classes, and it is high time to open up the interior-wiring question in its broadest aspects in an honest effort to see if some remedy cannot be found for the present formidable costs.

*The problem of supplying coal for continuous operation of electric service needed by the public will be the responsibility of the companies themselves during the coming winter. Fuel Administration regulations and preferential listings will not be effective. As a commercial issue the matter is one that no company can afford to belittle.*

# Construction Costs of Rice Rips Station

## Description of the Hydroelectric Installation of the Central Maine Power Company Erected at an Expenditure of $317,000 for Hydraulic Plant Power House and Equipment

BY J. A. LEONARD
Central Maine Power Company

THE Central Maine Power Company has completed a 2000-kva. hydroelectric power plant in the last few months which while not important as to size is notable because it was designed to carry peak loads rather than base loads, as is usually the case. In this respect it is somewhat analogous to a steam reserve plant. The Messalonskee River on which this plant is situated drains a comparatively small watershed—about

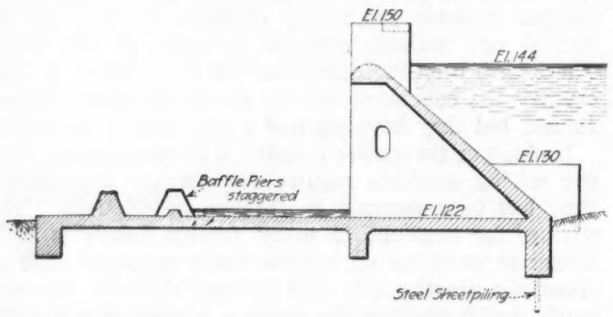



FIG. 1—STAGGERED BAFFLES BELOW DAM FORM STILLING POOL INTO WHICH SPILL WATER FALLS

200 sq.miles (500 sq.km.)—but is amply provided with storage. It is fed by the Belgrade Lakes, of which there are six having a combined area of about 28 sq.miles (75 sq.km.). Besides the new development known as Rice Rips the company has two others on the stream—one at Oakland and one at Waterville. The new station is furnishing energy to important shipbuilding plants at Bath, Me., and was built under priority regulations at a total cost of $317,000, or $158 per kva.

The general scheme of development embraces a dam 20 ft. (6 m.) high and 220 ft. (67 m.) long, from which a 10-ft. (3-m.) wood-stave penstock conveys the water 2300 ft. (700 m.) to a surge reservoir at the power house. This reservoir was formed by building a dam across a small gulley. The total fall is 42 ft. (13 m.), but as the losses in the penstock when the plant is operating under full load amount to 3 ft. (0.9 m.) the maximum net operating head is 39 ft. (12 m.). The normal flow of the river is about 200 sec.-ft. (6 cu.m. per sec.), whereas the water turbine installed in the plant uses 720 sec.-ft. (21.6 cu.m.), the difference being cared for, as mentioned before, by operating only on peak loads and utilizing storage.

*Dam.*—It was decided to place the foundations of the dam on the natural bed of the river, which consisted of closely compacted gravel underlaid at varying depths with clay. To meet these conditions a light reinforced cellular dam was erected on a reinforced-concrete mattress with a cut-off wall of sheet-steel piling driven to the underlying ledge or to penetration in the underlying clay. The water falls over a crest, which is almost semicircular in outline, into a stilling pool. Below this stilling pool, as shown in Fig. 1, are two lines of concrete baffle piers which are staggered with respect to each other. This design is so successful in retarding the velocity of the water that gravel that was left on the mattress or apron below the baffles was not disturbed after a spring high water.

One notable feature of the intake is a reinforced-concrete headgate 12 ft. (3.7 m.) square operated by chain hoists. This gate was extremely moderate in cost, is absolutely permanent and very efficient. During the construction of the dam temporary openings were left in the deck, which, when the work was completed, were closed by means of reinforced-concrete slabs, constructed in place upon the deck over the openings. Upon cutting the supporting cables, when it was desired to fill the pond, the slabs slid into place over the openings, making a permanent water-tight closure. This method was successfully used at the Hiram dam of the Cumberland County Power & Light Company, in Maine, which was designed by the writer.

*Penstock.*—The wood-stave penstock was constructed of kyanized Oregon fir, the pipe being furnished by the Continental Pipe Manufacturing Company and the kyanizing being done by the Brown Company. The penstock is laid in open cut and is supported for the greater part of its length on timber saddles. On account of the high cost of steel plate at the time the pipe was constructed, all curves of less radius than could be made with the wood staves are constructed of reinforced concrete.

*Power House.*—The headgates for the intake are reinforced concrete, being similar to the headgate at the

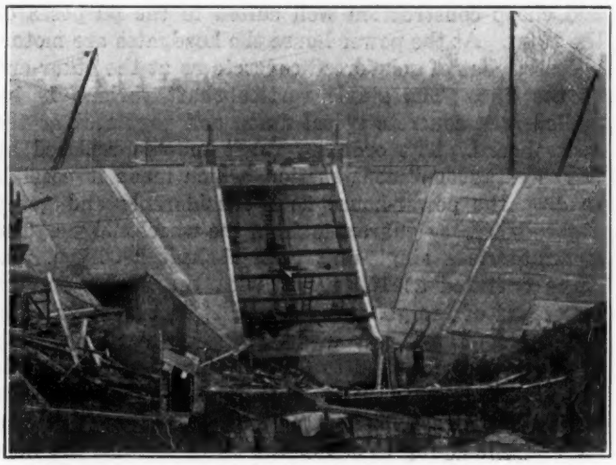


FIG. 2—SURGE RESERVOIR IN DAM ACROSS GULLEY

dam, except that they are operated by an electric motor. The turbine, which is a single-runner, vertical-shaft Allis-Chalmers machine rated at 2800 hp. and 150 r.p.m., is placed in a concrete spiral flume and regulated by an Allis-Chalmers governor controlled from the switchboard. In place of the customary curved draft tube, the turbine is provided with a White "hydraucone regainer." By

## DETAILED COSTS OF RICE RIPS PLANT, CENTRAL MAINE POWER COMPANY

| | |
|---|---|
| **Upper dam and intake:** | |
| Cofferdam | $4,482 |
| Pumping | 1,485 |
| Earth excavation, 1685 cu.yd. | 2,432 |
| Rock excavation, 385 cu.yd. | 2,030 |
| Sheet piling | 1,772 |
| Backfilling and embankment | 1,853 |
| Riprap | 250 |
| Forms (mass), 666 cu.yd. | 1,507 |
| Forms (reinforced), 1073 cu.yd. | 5,747 |
| Mixing concrete, 1739 cu.yd. | 1,526 |
| Placing concrete, 1739 cu.yd. | 1,966 |
| Reinforcing steel, hauling and placing | 720 |
| Gates and hoists | 1,143 |
| Rocks and supports | 974 |
| Ice and trash booms | 36 |
| Railings | 4 |
| Actual total | $27,934 |
| **Penstock:** | |
| Earth excavation and backfill, 3843 cu.yd. | $5,313 |
| Rock excavation, 1296 cu.yd. | 3,730 |
| Forms (mass), 37 cu.yd. | 156 |
| Forms (reinforced), 153 cu.yd. | 986 |
| Mixing, 190 cu.yd. | 161 |
| Placing, 190 cu.yd. | 522 |
| Reinforcing steel (hauling and placing) | 344 |
| Cradles and supports | 5,061 |
| Steel thimbles | 1,251 |
| Highway crossing | 1,428 |
| Wood-stave pipe (erected) | 30,868 |
| Wood-stave pipe (unloading and distribution) | 1,125 |
| Timber for sills | 121 |
| Timber for road crossing | 23 |
| Kyanizing | 3,992 |
| Actual total | $55,087 |
| **Forebay and surge reservoir:** | |
| Earth excavation, 1539 cu.yd. | $2,189 |
| Rock excavation, 477 cu.yd. | 911 |
| Forms (mass), 620 cu.yd. | 1,419 |
| Forms (reinforced), 1538 cu.yd. | 10,640 |
| Mixing, 2158 cu.yd. | 1,351 |
| Placing, 2158 cu.yd. | 3,007 |
| Reinforcing (steel hauling and placing), 60,000 lb. | 1,321 |
| Gates, hoists and miscellaneous | 1,667 |
| Rocks and supports | 1,828 |
| Trash booms | 139 |
| Actual total | $24,474 |
| **Tailrace:** | |
| Cofferdam | $854 |
| Pumping | 1,320 |
| Earth excavation, 623 cu.yd. | 631 |
| Rock excavation, 368 cu.yd. | 1,499 |
| Actual total | $4,305 |
| **Power house (substructure):** | |
| Cofferdam | $440 |
| Pumping | 3 |
| Earth excavation, 470 cu.yd. | 663 |
| Rock excavation, 232 cu.yd. | 959 |
| Forms, 878 cu.yd. | 2,619 |
| Form for draft tube | 1,193 |
| Mixing concrete, 878 cu.yd. | 149 |
| Placing concrete, 878 cu.yd. | 897 |
| Reinforcing steel, hauling and placing | 1,484 |
| Drains, manholes, etc. | 138 |
| Grading, backfilling, etc. | 489 |
| Actual total | $9,039 |
| **Power-house superstructure:** | |
| Walls | $2,989 |
| Structural steel | 1,705 |
| Doors, windows, etc. | 724 |
| Roof | 426 |
| Roofing waterproofing | 139 |
| Floor varnish | 62 |
| Lighting | 95 |
| Pumping | 46 |
| Painting | 128 |
| Actual total | $6,319 |
| **Turbine, etc.:** | |
| Waterwheel and governor, 2700 hp. | $23,079 |
| Freight | 176 |
| Unloading and teaming | 540 |
| Erecting | 1,275 |
| Actual total | $25,073 |
| **Electrical equipment:** | |
| Generator, 2000-kva., and exciter | $21,376 |
| Motor-generator set | 107 |
| Switchboard and wiring | 1,091 |
| Transformers | 441 |
| Freight | 224 |
| Unloading and teaming | 378 |
| Erecting | 1,097 |
| Headgate motors and equipment | 177 |
| Actual total | $24,894 |
| **Hydraulic plant equipment:** | |
| Power-house crane | $710 |
| Tools and gage | 20 |
| Actual total | $730 |
| **General:** | |
| Superintendence and engineering | $13,806 |
| Interest during construction | 831 |
| General office expense | 3,281 |
| Other items, commissary, bunk-house equipment, etc. | 16,219 |
| Total | $34,136 |
| **Construction plant equipment:** | |
| Including plant and machinery, $24,553; lumber, $11,911 | $57,358 |
| **Materials:** | |
| Cement, 7120 bbls. | $18,312 |
| Sand, 2875 cu.yd. | 952 |
| Rocks and crushing | 2,707 |
| Aggregate, 5645 cu.yd. | 16,396 |
| Steel, 210,000 lb. | 9,21 8 |
| Actual total | $47,585 |
| Grand total, approximately | $317,000 |

the use of this device for getting the water away from the runner, it was possible to lower the power-house floor about 10 ft. (3 m.), making a large saving of concrete. Furthermore, by using the "hydraucone" it was possible to secure a 2 per cent higher efficiency guarantee from the waterwheel builders than with a curved draft tube, making the efficiency at the best point 89 per cent.

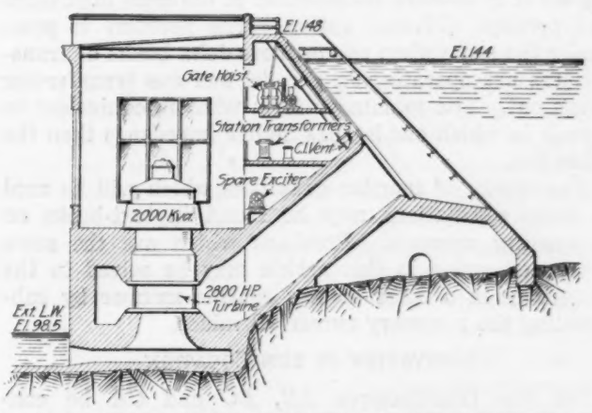



FIG. 3—GATES FOR INTAKE OPERATED BY MOTORS MOUNTED IN SPACE BETWEEN FOREBAY WALL AND STATION

The generator is a 2000-kva., 1600-kw., 0.8 power factor, 60-cycle, 150-r.p.m. General Electric machine fitted with a spring-thrust bearing. The exciter is mounted on the end of the generator shaft. The switchboard is on the floor of the power house near the generator.

From the switchboard leads pass through the brick

wall of the power house in porcelain bushings to an outdoor transformer station where are located three single-phase Maloney outdoor-type transformers each rated at 667 kva., 2300/33,000-volts. The overhead buses, switches, choke coils, etc., are supported on six reinforced-concrete poles, with steel angle cross supports.

*Transmission Lines.*—From the power house one 2200-volt line connects with one of the existing stations at Oakland about two miles (3.2 km.) up stream. Besides this is a 33,000-volt tie line connecting with one of the main trunk lines of the Central Maine system which runs from Shawmut Station on the Kennebec to the Fort Halifax Station on the Sebasticook River. This tie line is 4½ miles (7.2 km.) long, and is carried on cedar poles measuring 30 to 50 ft. (9 to 15 m.) in length, and spaced about 200 ft. (60 m.) apart. Three steel-reinforced aluminum cables equivalent to No. 1/0 gage are employed, being supported on two cross-arms by Thomas No. 3055 insulators with Lee steel pins. A ground wire of $\frac{5}{16}$-in. (8-mm.) high-tension steel is carried at the top of the poles by Seavey special ridge irons and grounded at every fifth pole. Near Fairfield the tie line crosses the Kennebec River, with an 824-ft. (250-m.) span having a 30-ft. (9-m.) sag. For the crossing three No. 3/0 steel reinforced aluminum cables are used. This space is supported by timber towers made of dimensioned spruce, one 45 ft. (14 m.) high and the other 60 ft. (18 m.).

The general plan of the project was outlined by J. F. Vaughan, consulting engineer of Boston, but owing to his absence in charge of the New England division of the Emergency Fleet Corporation during the war, his assistant, E. A. Ekern, acted as consulting engineer. Frank H. Mason, chief engineer of the Central Maine Power Company, looked after the work for the company, and the writer, in connection with the engineering department of the Central Maine Power Company, designed the dam, surge reservoir and power house. The work was done by the construction department of the Central Maine Company, W. G. Elliott being superintendent and Arthur Page engineer-in-charge of the work.

# Loading a Bank of Dissimilar Transformers

## When Transformers with Different Characteristics Are Banked the Load Is Not Uniformly Distributed Among Them—Simple Calculations Are Proposed for the Determination of the Current in Each Transformer for Balanced Load

BY H. B. DWIGHT
Canadian Westinghouse Company, Limited

THE problem of calculating the amount of load carried by each of the transformers in a bank connected delta-delta, when the transformers have different characteristics, arises somewhat frequently. For instance, when a number of different transformers is on hand, it is desirable to calculate how large a three-phase load they will carry when connected in delta. The same problem occurs when one transformer of a bank burns out and it is desired to replace it by another transformer of different impedance and perhaps different rating. The problem is practically the same when two or more delta banks of transformers are operating in parallel and one transformer burns out. The remainder form what is equivalent to a bank in which one leg has higher impedance than the other two.

The theory of complex quantities which will be used in these calculations may be found in text-books on alternating currents. Problems which are the same as the examples in this article may be solved in the same way in a more or less routine manner by substituting the necessary numerical values.

### DERIVATION OF THE EQUATION

Let the transformers *AB*, *BC* and *CA* be connected in delta. (See Fig. 1.) Find the resistance and reactance of each in ohms referred to either high tension or low tension. Since resistance and reactance are usually specified as percentages, the following formula may be used:

$$\text{Ohms} = \frac{E^2\ (\text{percentage})}{100{,}000\ (\text{kva.})} \qquad (1)$$

where $E$ is the rated voltage, either high tension or low tension, where "percentage" is the percentage resistance or reactance of the single-phase transformer, and where (kva.) is the rated kva. of the transformer. The ohms of resistance or reactance given by (1) will be referred to the high-tension or the low-tension side of the transformer according to the value of $E$ which is used.

Assume that a balanced three-phase load current is taken from the bank. The currents in the three lines *A*, *B* and *C* may be represented as follows:

$$I_A = I \qquad (2)$$

$$I_B = -0.5\ I + j\ 0.866\ I \qquad (3)$$

$$I_C = -0.5\ I - j\ 0.866\ I \qquad (4)$$

If imaginary quantities are plotted at right angles to real quantities, representing 90 deg. difference in phase, the above three currents will be seen to be equal in magnitude and 120 deg. apart in phase.

Let the current in transformer *CA*, which is unknown, be

$$i_1 = i_p + ji_q \qquad (5)$$

in the direction *CA*. The currents in the other transformers may be derived from $i_1$, and are

$$i_2, \text{ in direction } AB, = i_1 - I_A = i_p + ji_q - I \qquad (6)$$

and $i_3$, in direction $BC$, $= i_3 - I_B = i_p + ji_q - 0.5\ I - j\ 0.866\ I$ (7)

The impedance drops in the transformers are:

$$\text{Drop in } CA = (i_p + ji_q)\ (r_1 + jx_1) \qquad (8)$$

$$\text{Drop in } AB = (i_p + ji_q - I)\ (r_2 + jx_2) \qquad (9)$$

$$\text{Drop in } BC = (i_p + ji_q - 0.5\ I - j\ 0.866\ I)\ (r_3 + jx_3) \qquad (10)$$

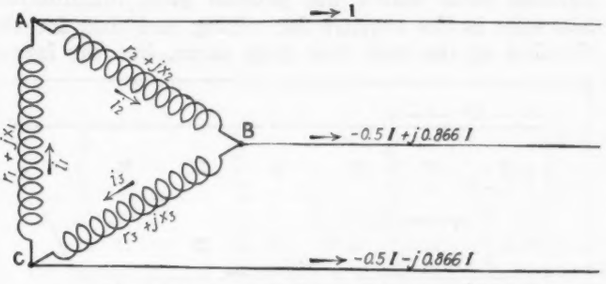
Since these transformers are connected in delta and have balanced voltages impressed on them, the sum of the above three drops is zero, that is, the sums of the

real and imaginary parts are each equal to zero. Therefore,

$$i_p\ (r_1 + r_2 + r_3) - i_q\ (x_1 + x_2 + x_3) - I\ (r_2 + 0.5\ r_3 - 0.866 x_3) = 0 \quad (11)$$

and $$i_p\ (x_1 + x_2 + x_3) + i_q\ (r_1 + r_2 + r_3) - I\ (x_2 + 0.5 x_3 + 0.866\ r_3) = 0 \quad (12)$$

Now substitute the numerical values of resistance and reactance in (11) and (12) and these equations become very simple and the values of $i_p$ and $i_q$ are readily found in terms of $I$, as in the examples which follow. Then $i_1$, $i_2$ and $i_3$ are found in terms of $I$ and a value of the load current $I$ can be found which will not overheat any of the transformers.*




REPRESENTATION OF CURRENTS IN DELTA TRANSFORMER BANK

*Example I.*—Find the greatest three-phase load which can be carried without overloading any of the transformers of a bank made up of two 100-kva. transformers of 0.80 per cent resistance and 0.77 per cent reactance and one 100-kva. transformer of 1.04 per cent resistance and 4.00 per cent reactance.

Refer all quantities to the high-tension side, 2200 volts.

By formula (1)

$$r_1 = r_2 = 0.387 \text{ ohm}$$
$$x_1 = x_2 = 0.373 \text{ ohm}$$
$$r_3 = 0.504 \text{ ohm}$$
$$x_3 = 1.936 \text{ ohm}$$

By formulas (11) and (12)

$$1.278\ i_p - 2.682\ i_q = -1.038\ I$$
$$\text{and } 2.682\ i_p + 1.278\ i_q = 1.777\ I$$

Therefore,

$$1.63\ i_p - 3.43\ i_q = -1.33\ I$$
$$7.20\ i_p + 3.43\ i_q = +4.77\ I$$
$$8.83\ i_p = 3.44\ I$$
$$i_p = 0.390\ I$$

From this,

$$i_q = 0.573\ I$$
$$i_1^2 = (0.390^2 + 0.573^2)\ I^2$$
$$i_1 = 0.693\ I \text{ amperes, numerical value.}$$

Similarly, from equations (6) and (7),

$$i_2 = 0.837\ I \text{ amperes, numerical value,}$$
$$\text{and } i_3 = 0.313\ I \text{ amperes, numerical value.}$$

Each of the transformers can carry a current of 45.5 amperes, high tension, without being overloaded. Transformer $AB$, carrying $i_2 = 0.837\ I$, has the heaviest load. In order that none of the transformers be overloaded,

$$0.837\ I = 45.5 \text{ amperes.}$$
$$I = 54.3 \text{ amperes.}$$

Kva. of load = 207 kva., which is 69 per cent of 300 kva., the nominal rated capacity of the three transformers.

*Example II.*—Two banks of delta-connected, 500-kva., 10,000-volt transformers are operating in parallel, the resistance of each transformer being 2 ohms and the reactance 6 ohms. Find what percentage of the original load can be carried without overloading any unit when one of the transformers is disconnected.

The remaining five transformers form an equivalent bank in which

$$r_1 = r_2 = 1 \text{ ohm.}$$
$$x_1 = x_2 = 3 \text{ ohms.}$$
$$r_3 = 2 \text{ ohms.}$$
$$x_3 = 6 \text{ ohms.}$$

From formulas (11) and (12),

$$4\ i_p - 12\ i_q = -3.20\ I$$
$$\text{and } 12\ i_p + 4\ i_q = 7.73\ I$$

Then

$$36\ i_p + 12\ i_q = 23.20\ I$$
$$40\ i_p = 20\ I$$
$$i_p = 0.5\ I$$

Then

$$i_q = 0.433\ I$$

From (5),

$$i_1^2 = (0.5^2 + 0.433^2)\ I^2$$
$$i_1 = 0.662\ I \text{ amperes, numerical value.}$$

From (6),

$$i_2 = 0.5\ I + j\ 0.433\ I - I$$
$$i_2 = 0.662\ I \text{ amperes, numerical value.}$$

From (7),

$$i_3 = 0.5\ I + j\ 0.433\ I - 0.5\ I - j\ 0.866\ I = -j\ 0.433\ I$$
$$i_3 = 0.433\ I \text{ amperes, numerical value.}$$

The current $i_3$ is carried by one 500-kva., 10,000-volt transformer alone, whose current rating is 50 amperes. Therefore, in order that it be not overloaded,

$$0.433\ I = 50 \text{ amperes}$$
$$I = 115.5 \text{ amperes}$$

$$\text{Total load} = 115.5 \times \frac{10{,}000}{1000} \times 1.732 = 2000 \text{ kva.}$$

If all the six transformers were in operation, each could carry 50 amperes and the total load would be 3000 kva. Therefore, when one of the six transformers is disconnected, the capacity of the two banks is reduced to 66 per cent of the original capacity. This is true in general of any six transformers having similar characteristics to each other.

*A more general solution of this problem, suitable for unbalanced loads, has been given by Charles L. Fortescue, "Standard Handbook for Electrical Engineers, fourth edition, page 408.

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IN THESE days—and I think quite happily—the notion of public ownership is not so popular as it was. We have not in the course of our recent experimentations become entirely satisfied with the action of public authority in the administration of great public instrumentalities. That is not necessarily the fault of the administrators. There is an inherent difficulty in the problem itself. Certainly at this time, as I understand it, we are not at all disposed to turn over to public ownership and operation that which can be suitably administered by private ownership and operation under proper public supervision. . . . There is no use talking of setting up great institutions of international justice if we do not have a regard for the essentials of justice at home. There is no use talking of the benediction of America to mankind if we cannot in the city of New York run our public utilities with absolute fairness.—*Charles E. Hughes.*

# Design of Industrial Lighting Systems—II

## Solution of a Typical Problem in Industrial Lighting Design Showing How to Determine Correct Size and Proper Spacing of Lighting Units to Produce the General Illumination Required by the Work

BY WARD HARRISON AND H. H. MAGDSICK
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In the first part of this article, published in the ELECTRICAL WORLD July 19, very complete data were given showing the best practice in illumination intensities for all important industries. Charts were also presented for the determination of the utilization constants which should be realized with various lighting units for different conditions of walls and ceilings and for any ratio of width of room to mounting height of unit. In the present article the general problem of selecting and locating the lighting unit, of correct size and type, is discussed. A typical example of this nature is worked out to illustrate the correct application of available data to the design of an industrial plant lighting system.

IN ADDITION to increasing the total lumens provided by the lamps to compensate for losses in utilization, as discussed in the first article of this series, a still further increase must be made initially so that the inherent depreciation of candlepower in the lamps and the collection of dust and dirt will not bring the average illumination in service below the value desired. The average lumen output of gas-filled lamps during life is about 95.5 per cent of the initial. Fig. 1 shows the results of comparative tests on the effect of dust and dirt collection on glass and steel reflector installations under identical atmospheric conditions. After four weeks the depreciation in light output from open reflectors ranges from 10 to 25 per cent. Under more extreme conditions of dust and smoke the depreciation in this period may run as high as 40 per cent or greater. If, in the usual locations, the lighting units are cleaned regularly once a month, and, under more extreme conditions, at shorter intervals, the average loss due to the

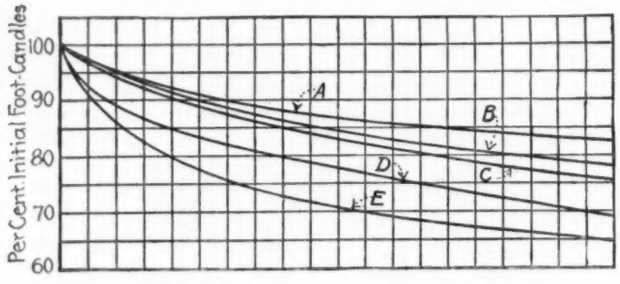



FIG. 1—DEPRECIATION DUE TO DUST COLLECTION ON LAMPS AND REFLECTORS

A—Dome enameled steel. B—Bowl enameled steel. C—Dense opal glass. D—Prismatic glass. E—Light density opal glass.

inherent depreciation in lamp candlepower and the effect of dust and dirt collection need not exceed 20 per cent. In designing an installation it is well to multiply by a "depreciation factor" of from 1.2 to 1.3, or even to 1.4, the light output which would be required initially when lighting units are new and clean. The calculation of the total required light flux is, then, made as follows:

$$\text{Total lumens} = \frac{\text{foot-candles} \times \text{area in sq.ft.} \times \text{depreciation factor}}{\text{coefficient of utilization}}$$

In industrial lighting particularly it is desirable, for a given total wattage, to employ the least number of lighting units which will provide good illumination. Not only is the expense for wiring and that for the cleaning of the unit thus kept down, but the larger

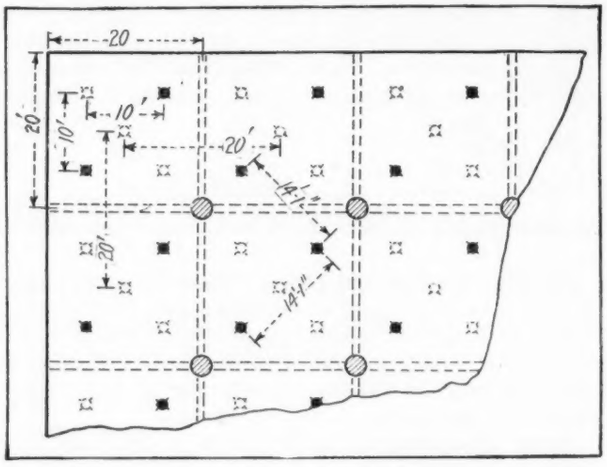



FIG. 2—VARIOUS SOLUTIONS OF LAMP LOCATION PROBLEM

When the proportions of an interior are such that the installation of one unit per bay will not provide satisfactory illumination and where four units per bay are not necessary, the installation of two units on one diagonal is a good method.

lamps are appreciably higher in efficiency. The problem is decided primarily by the minimum number necessary to provide reasonably uniform lighting, to supply light from a sufficient number of directions to illuminate adequately surfaces in all vertical planes, and to make the distance between units such that the light does not fall upon any working surfaces so obliquely as to make it likely that a person will stand in his own light. In general, with the units commonly employed in industrial lighting, an arrangement which provides reasonably uniform illumination will also provide satisfactory illumination of vertical surfaces and will obviate long, dense shadows.

On the other hand, lighting units could readily be designed which would provide uniform illumination when so widely separated that the installation would be unsatisfactory from these last two standpoints.

### SPACINGS FOR DIFFERENT TYPES OF UNITS

The maximum spacings recommended for various types of units, expressed as ratios of the mounting height above the plane of the work, are listed in Table I. Thus, if dome-type enameled-steel reflectors are to be mounted 10 ft. (3 m.) above the work, the maximum spacing recommended is seen to be 10 by $1\frac{2}{3}$, or $16\frac{2}{3}$ ft. (5 m.). Such factors as the structural features of the building, the position of shafting, the paths traveled by cranes, etc., often play an important part in determining the location of the units, and it may frequently be found desirable to adopt spacings closer than those indicated by

the ratios of the table. Closer spacings increase, rather than decrease, the effectiveness of the illumination.

Usually a large room is divided by columns or ceiling beams into a number of symmetrical bays, and under these conditions it is usually desirable that the units of a general lighting system be located symmetrically with respect to each bay and approximately in squares. Sometimes the proportions of interiors are such that a single outlet in the center of each bay will fill the requirements; again, the installation of four outlets per bay may be satisfactory; or where long rectangular bays are found, two, three or four units in a row may be desirable. Not infrequently, however, the proportions of the interior are such that the location of the least number of units to supply the required illumination calls for considerable planning in the design. Such a problem is presented by square bays measuring 20 ft. (6.1 m.) on a side, and rectangular bays measuring 16 ft. (4.9 m.) by 20 ft., (6.1 m.), and their occurrence in modern industrial plants is sufficiently common to warrant a somewhat detailed discussion of their lighting.

On a 20-ft. spacing, dome reflectors should be mounted not less than 12 ft. (3.1 m.) above the plane of the work. Ordinarily this calls for a minimum ceiling height of 16 ft. (4.9 m.). Hence, where bays 20 ft. (6.1 m.) square are encountered, the use of a single unit per bay would not regularly be recommended unless the ceiling height were 16 ft. (4.9 m.) or more. On the other hand, four units per bay on a 10-ft. spacing may be used where the ceiling height is not less than 10 ft., and their installation is good practice in all cases where the height ranges between 10 ft. and 16 ft. (4.9 m.). However, where the ceiling height is 12½ ft. (3.8 m.) or more, two dome reflector units per bay staggered as shown by the solid circles of Fig. 2 will answer the requirements at somewhat lower operating cost. Attention is called to

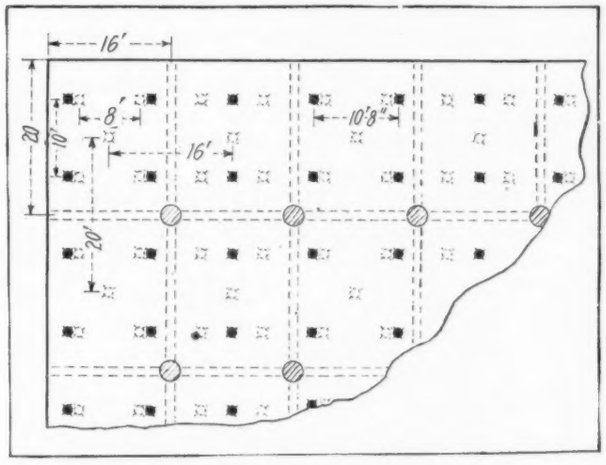



FIG. 3—ANOTHER EXAMPLE OF LAMP LOCATION

The solid circles indicate a scheme of non-symmetrical spacing frequently applicable to rectangular bays where one unit per bay will not provide satisfactory illumination yet where four per bay are not necessary

the ease with which an extra unit may be installed between every two units comprising the outside rows to provide an especially high lighting intensity for bench work.

Where bays measuring 16 by 20 ft. (4.9 by 6.1 m.) are found, one dome-type unit per bay will not provide uniform illumination unless a mounting height above the work of 12 ft. (3.6 m.) calling for a minimum ceiling height of 16 ft. (4.9 m.) is practicable. Four units per bay are not necessary unless the ceiling height is less than 10½ ft. (3.1 m.), and if less than 10 ft. (3 m.) six units are required. Between these ceiling heights, units mounted 10 ft. 8 in. (3.2 m.) apart in the direction of the room crosswise of the bays and 10 ft. (3 m.) apart lengthwise of the bays, as shown in Fig. 3, provide uniform illumination at an average installation of three outlets per bay. This outlet is particularly suitable where the number of bays in the room in a direction crosswise of the bays is odd, which brings a bay of four units at each end.

There is one factor that operates to encourage stretching the spacing ratio just a little; this is where the installation of a single unit per bay would barely exceed the permissible spacing. Under these conditions it is well to remember that a single large gas-filled lamp supplies a full third more light than four smaller lamps to-

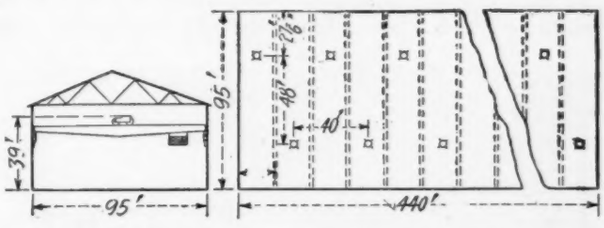



FIG. 4—FLOOR PLAN AND ELEVATION OF ERECTING ROOM DISCUSSED IN THE PROBLEM

taling an equal wattage. While a spacing in excess of the maximum recommended will result in non-uniformity, nevertheless, if the ratio is not greater than two the illumination supplied by the single large lamp will at the point of minimum intensity be practically equal to the illumination supplied by the four smaller lamps, and will, of course, be higher at all other points. However, it must be remembered when the spacing is being decided that the number of sources directing light to an object is reduced when the spacing is increased to such a ratio, and, too, that the light from the units reaches these objects more obliquely and forms more troublesome shadows. The use of a single large unit instead of four smaller ones is principally applicable in commercial lighting, but occasionally it offers the best solution of an industrial lighting problem. It is decidedly advantageous in all industrial lighting to avoid a spacing distance greater than twice the mounting height above the plane of the work.

## DETERMINATION OF SIZE OF LAMP

With the total number of units determined, the total light flux to be supplied by each lamp may be found at once by dividing the total flux for the area by the number of lamps. Table II lists the sizes of lamps available with the lumens furnished by each, and from this the size giving approximately the output desired may be selected. Where the rated lumens of the nearest lamp are considerably below the desired output, it is usually advisable to use the next larger size, for the lighting system will be certain to prove inadequate with the latter, while with the smaller lamps it may not be satisfactory.

To illustrate the practical application of the design procedure, an actual installation will be taken up in detail.

It is desired to design a lighting installation for the erecting room of a large industrial plant manufacturing large engine parts, cranes, etc. The work carried on in

this room can be classed as assembly work, medium grade. The floor plan and end elevation are shown in Fig. 4. The following data form the basis for calculations:

Length—440 ft. (134 m.), 20-ft. (6-m.) bays.

Width—95 ft. (28.9 m.).

Distance from floor to cross beam of roof truss—44 ft. (13.4 m.).

Distance from floor to top of crane—39 ft. (11.8 m.).

Color of walls and ceiling—medium.

For a lighting installation of this kind the units must either be mounted high in order to clear the traveling crane or else they must be on the side walls below the crane.

The latter method, because of the difficulty of avoiding annoying glare, should be considered only where the interior is very high in comparison with its width. In this case the width is about three times the maximum height at which angle reflectors would be mounted, and

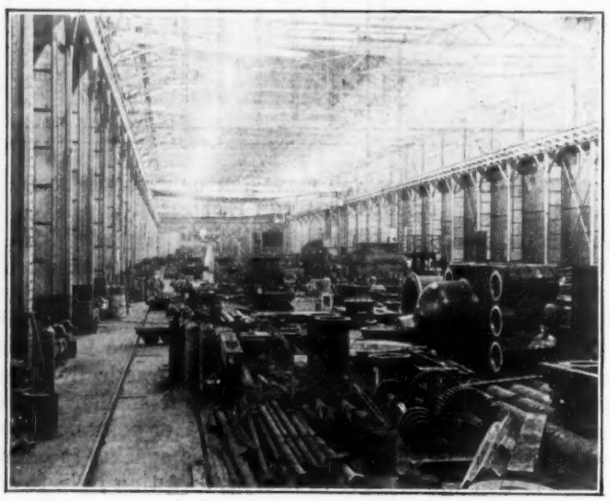


FIG. 5—SOLUTION OF A LIGHTING PROBLEM

it would be practically out of the question to avoid glare. Locating the units overhead will be found more satisfactory, and since most of the working materials are not polished and will not give rise to glaring reflections, the dome-shaped porcelain-enameled steel reflector and clear gas-filled lamp will supply a satisfactory quality of illumination, and this more economically than would angle units.

Table I gives 1⅔ as the maximum spacing ratio for dome-shaped steel reflectors. In this installation the hanging height of the units is somewhat limited because of the necessity of providing clearance for the traveling crane. The units must be suspended above the crane, preferably below the roof trusses. If the units are located about 1 ft. (0.3 m.) below the cross bar of the roof truss, the hanging height above the working plane will be approximately 40 ft. (12.2 m.). The maximum allowable spacing would then be about 66 ft. (20.1 m.). Since the width of the room is 95 ft. (29 m.), the spacing provided when one row of units is used is in excess of that which is allowable; two rows of units will, however, be sufficient. By using two rows and locating units every third bay a 60-ft. (18-m.) spacing is provided one way and approximately a 48-ft. (14.6-m.) spacing the other way. Such an arrangement will prove satisfactory if the sixteen units will supply sufficient light for the purpose at hand.

The table of lighting intensities gives 3 to 9 foot-candles as satisfactory intensities for assembly work of medium grade. For this installation an intensity of 4 foot-candles is chosen. As there is very little smoke or

TABLE I—RECOMMENDED MAXIMUM SPACINGS AND MINIMUM MOUNTING HEIGHTS FOR VARIOUS UNITS

(Mounting height equals distance of light source above plane of illumination)

| Equipment | Ratio of Spacing to Mounting Height* |
|---|---|
| Prismatic, mirrie or aluminum: | |
| Intensive | 1½ |
| Focusing | ¾ |
| Extensive | 1⅔ |
| Indirect or semi-indirect | 1½ |
| Opal or porcelain enamel: | |
| Bowl | 1⅔ |
| Dome | 1⅔ |
| Totally inclosing class | 1⅔ |
| Semi-inclosing | 1½ |

* To get maximum spacing distance, multiply ratio by mounting height.

† Height equals distance between ceiling and plane of illumination.

steam in this room, the atmospheric conditions are not considered extreme. However, there is certain to be some dust collection on the lighting units, and therefore the desirable intensity should be multiplied by a depreciation factor of 1.25 to insure that the average maintained intensity will not fall below the desired value. This gives an initial intensity of 5 foot-candles. The coefficient of utilization for dome-shaped porcelain-enameled steel reflectors for this particular room as calculated from the values given in Table II is found to be 0.50. The total generated lumens necessary to produce the initial intensity on the working plane are

$$(5 \times 95 \times 440) \div 0.05 = 418{,}000 \text{ lumens.}$$

Since a total of 418,000 lumens must be supplied, each of the sixteen lamps must furnish 26,120 lumens. Table II shows, however, that the largest lamp—the 1000-watt gas-filled—supplies only 19,300 lumens; hence it is evident that sixteen units will not be sufficient to supply the required amount of light. If, however, two units are installed in every other bay, a 40-ft. (12.1-m.) spacing lengthwise is provided and the number of units would be twenty-two. If twenty-two units are to be used, each lamp must supply 418,000 ÷ 22, or approximately 19,000 lumens. The best solution of the problem

TABLE II—LUMEN OUTPUT OF MAZDA LAMPS

| Size of Lamp in Watts | Vacuum — Standard Lighting Service 110–125 Volts | Vacuum — Standard Lighting Service 220–250 Volts | Gas-Filled — Standard Lighting Service 110–125 Volts | Gas-Filled — Standard Lighting Service 220–250 Volts | "Daylight" 110–125 Volts |
|---|---|---|---|---|---|
| 10 | 75.0 | .... | .... | .... | .... |
| 15 | 125 | .... | .... | .... | .... |
| 25 | 222 | 191 | .... | .... | .... |
| 40 | 370 | .... | .... | .... | .... |
| 50 | 472 | 422 | .... | .... | .... |
| 60 | 575 | .... | .... | .... | .... |
| 75 | ... | .... | 865 | .... | 600 |
| 100 | 995 | 905 | 1,260 | .... | 870 |
| 150 | ... | 1,420 | 2040 | .... | 1,400 |
| 200 | ... | .... | 2,920 | 2,520 | 2,000 |
| 250 | ... | 2,620 | .... | .... | .... |
| 300 | ... | .... | 4,840 | 4,100 | 3,360 |
| 400 | ... | .... | 6,700 | 5,850 | .... |
| 500 | ... | .... | 8,750 | 7,400 | 5,600 |
| 750 | ... | .... | 13,900 | 12,600 | .... |
| 1,000 | ... | .... | 19,300 | 17,500 | .... |

is found, therefore, in the choice of the 1000-watt lamp. Fig. 5 shows the lighting installation as described in this problem—with the exception that in this case the units were staggered to decrease crane shadows and to improve the illumination at the ends of the building.

# NEW CLASSIFICATION OF ELECTRICAL EXPORTS

## Tentative Schedule to Receive Final Approval Shortly and Be Put Into Force on the First of Next January

THE committee on the classification of commodities imported and exported, appointed last November and composed of representatives of the Treasury Department, the Bureau of Foreign and Domestic Commerce and the Bureau of the Census in the Department of Commerce, the Shipping Board, the War Trade Board and the Traffic Commission, has recently presented to Secretary Glass and to Secretary Redfield a plan for revision of the present classification of imports and exports which has received their approval. When final revisions are made in this schedule it will be printed and distributed to all custom houses and consulates of the United States government and will go into effect on Jan. 1, 1920.

The new scheme represents an entire reconstruction of the grouping of commodities and has been developed along scientific lines. It is based on the decimal system, making it possible not only to use the most efficient mechanical tabulating devices but also to give elasticity to the system by making it possible to expand or contract the classification as trade conditions change.

The general clasification has been almost completely determined, and only minor changes are expected. The classification of particular groups is, however, still tentative and subject to revision. The classification of exports of electrical machinery and apparatus printed below is in the hands of G. B. Roorbach, of the United

### 75—ELECTRICAL MACHINERY AND APPARATUS

Class and Commodity

#### 750-751—GENERATING APPARATUS AND PARTS

Code No.

7500 Generators, steam-turbine-driven, direct-current, under 500 kw.
7501 Generators, steam-turbine-driven, direct-current, 500 kw. or over
7504 Generators, steam-turbine-driven, alternating-current, under 2000 kw.
7505 Generators, steam-turbine-driven, alternating-current, 2000 kw. or over (The turbine not included; see 721 for turbines)
7508 Self-contained lighting outfits (as farm-lighting outfits)
7510 Other generators, direct-current (not including automotive lighting generators), under 500 kw.
7511 Other generators, direct-current (not including automotive lighting generators), 500 kw. or over
7514 Other generators, alternating-current, including synchronous motors under 2000 kw.
7515 Other generators, alternating-current, including synchronous motors, 2000 kw. or over

#### 752—TRANSFORMING APPARATUS

7520 Transformers: constant potential and constant current
7521 Transformers: instrument and relay
7522 Regulators: induction feeder voltage
7523 Rectifiers (electric valves, including mercury rectifiers and all others)
7524 Converting apparatus (synchronous condensers, motor-generator sets, direct-current generators, dynamotors, synchronous condensers, frequency changes and rotary phase converters

#### 753—TRANSMITTING AND DISTRIBUTING APPARATUS AND SUPPLIES

7530 Switchboards and panelboards, complete (not including telephone switchboards)
7531 Meters, measuring and indicating instruments, relays and generator voltage regulators
7532 Circuit breakers, switches, fuses, fuse plugs.
7533 Protective devices (lightning arresters, choke coils, reactors)
7534 Outlet and switch boxes
(For wire, bare or insulated, see 60 and 66; for electrical porcelain see 5313, and for conduit (clay) see pottery 5393; for glass insulators see 5295; for pole-line hardware see 618)

#### 754-755—MOTORS, STARTERS, CONTROLLERS, INCLUDING ELECTRIC LOCOMOTIVES AND PARTS

7540 Stationary motors, direct-current (not including starters and controllers), under 200 hp.
7541 Stationary motors, direct-current (not including starters and controllers), 200 hp. and over
7542 Stationary motors, alternating-current (not including control equipment), under 200 hp.
7543 Stationary motors, alternating-current (not including control equipment, 200 hp. or over
7544 Railway motors (not including control), direct-current
7545 Railway motors (not including control), alternating-current
7546 Vehicle motors, not including control
7547 Automotive motors (includes starting motors, lighting generators and combined motor-generators, exclusive of control equipment)
7548 Marine motors, not including control
7550 Rheostats, controllers, control equipment, motor-starting and speed-controlling devices
7555 Electric locomotives, mining and industrial
7556 Electric locomotives, railway

#### 756—ELECTRIC APPLIANCES AND PARTS

7560 Fan motors (electric fans, desk—wall, ceiling and column)
7561 Vacuum cleaners
7562 Flatirons

#### 756—ELECTRIC APPLIANCES AND PARTS (*Continued*)

Code No.

7563 Domestic heating and cooking, devices, not elsewhere specified
7564 Electric furnaces and ovens (industrial)
7565 Therapeutic apparatus

#### 758—SIGNAL AND COMMUNICATION DEVICES

7580 Radio and wireless apparatus
7581 Police, fire and burglar alarm apparatus
7582 Telegraph apparatus, not elsewhere specified
7583 Telephone apparatus, not elsewhere specified (includes substation instruments, interior systems, switchboards, etc.)
7584 Railway signals, switches and attachments
7585 Electrical clocks and time mechanisms

#### 759—ELECTRIC MACHINERY AND APPARATUS (NOT ELSEWHERE SPECIFIED)

7590 Ignition apparatus (spark plugs and ignition magnetos)
7591 Batteries, primary (dry or wet)
7592 Batteries, storage (lead or alkaline)
7599 Electrical machinery, n. s. p. f.
(For rubber battery jars and covers see No. 4056 rubber)
(For carbons and electrodes see No. 5, minerals)
(For lamps and lighting devices, see No. 9)

#### 701—STEAM ENGINES, BOILERS AND CONDENSERS

7011 Locomotives
7012 Marine engines (except turbines)
7013 Stationary and portable engines (except turbines)
7014 Turbines
7015 Traction and caterpillar engines
7016 Boilers, steam-poer generating
7017 Condensers

#### 702—INTERNAL-COMBUSTION ENGINES

7021 Automobile engines
7022 Motorcycle engines
7023 Aeroplane engines
7024 Motorboat engines
7025 Gasoline locomotives
7026 Diesel or Diesel type (heavy oil burning)
7027 Traction and caterpillar engines
7028 Stationary or portable not elsewhere specified (gas, gasoline, kerosene or alcohol)
7029 Internal-combustion engines, not elsewhere specified (includes hot-air engines)
(For electric locomotives see 78)

#### 703—WATERWHEELS, MOTORS AND TURBINES

7031 Under 1 hp.
7032 1 hp. to 500 hp.
7033 500 hp. or over
7040 (794) Windmills

#### 536—CARBONS AND ELECTRODES

LIGHTING CARBONS

53611 Made from petroleum coke
53612 Made from lamp black or retort carbon
53613 For flaming-arc lamps, n. s. p. f.
Electrodes, brushes, plates or disks, battery pots of carbon
53694 Furnace
53695 Welding
53696 Brushes and battery, not elsewhere specified
53697 Porous pots for batteries
53699 All other manufactures of carbon, n. s. p. f.

States Shipping Board, 714 Munsey Building, Washington, D. C., who will be glad to receive any suggestions for changes. Mr. Roorbach, who is chairman of the committee which has made the new classification, explained to a representative of the ELECTRICAL WORLD that from an administrative standpoint the facilities for collecting and tabulating the information would not permit of a more minute treatment of the electrical machinery group.

Electrical machinery and apparatus are included in group 7500 as below. It will be noted that power generating machinery comes under the general classification of machinery and vehicles, group 7000. Carbons and electrodes are, however, included under mineral products, group 53,600. Electric lamps have also been separated from the class of electrical apparatus and have been grouped under the number 9940, "lamps and other lighting devices." The classes are arc lamps, incandescent lamps (both carbon and metallic filaments), flashlights, and all other electric lamps (including vapor lamps). Glass bulbs for incandescent lamps, globes and shades have been placed in the glass schedule.

# Effect of Actions Inside Furnaces on Performance

## Causes of Fluctuation in Load, Limitations to Short-Circuit Current, Stabilization of Arc and High-Power-Factor Furnaces from Service Viewpoint

BY W. K. BOOTH
Chief Engineer Booth-Hall Company

IN THE installation of electric furnaces, the effect of the power factor at which the furnace normally operates on the power supply lines is in many cases not given sufficient study and consideration. As a result the furnace operation often causes disturbances on the power service lines which could have readily been avoided if an adequate survey of the power conditions had been made at the start.

It is not merely necessary to know that the furnace will operate with a power factor of 0.90 to 0.95, but the investigation must go deeper and determine just what this means. The most desirable condition is that the furnace should operate at the highest possible power factor without causing undue disturbances at the generating station or to other consumers of electricity from the same power plant.

To understand fully the operating conditions of an electric arc furnace for melting steel, it is, perhaps, desirable to consider what takes place in the furnace when melting a charge of cold steel scrap.

Considering the "direct arc" furnace, where the electrodes are suspended vertically through the roof and the arc forms between the electrodes and the steel scrap, the action which takes place is substantially the same regardless of the make or type of the furnace. To form the arc the electrode is lowered until it comes in contact with the scrap and then raised out of contact so that the arc is drawn in the space between the electrode and the scrap. At the instant of contact of the electrode with the scrap there occurs practically a short circuit in the furnace, the current surge being limited only by such resistance to the flow of current as may be furnished by the charge in the furnace and the furnace leads and the reactance of the circuit. In other words, the amount of the current surge under such conditions is limited by the impedance of the furnace circuit.

During the early stages in melting down there is considerable fluctuation of the arc, that is, the arc goes out and is reformed by again bringing the electrode in contact with the charge and drawing the arc. There are three reasons for this:

(1) The scrap melts away from beneath the electrodes and so causes the arc to break.

(2) To maintain an arc* the cathode must be kept at a high temperature, which is difficult with an alternating current, because at one instant the electrode is the cathode and the steel scrap the anode, and at the next instant the relationship is reversed. It is much harder to keep a hot spot on the steel scrap than it is on the carbon electrode because steel conducts heat away more rapidly than does carbon. Besides steel melts and vaporizes more readily than carbon and heat is used in producing these changes. Consequently in starting an arc furnace on a cold charge, until a small pool of molten metal has formed under the electrode, the arc will go out a number of times owing to the fact that the metal cannot

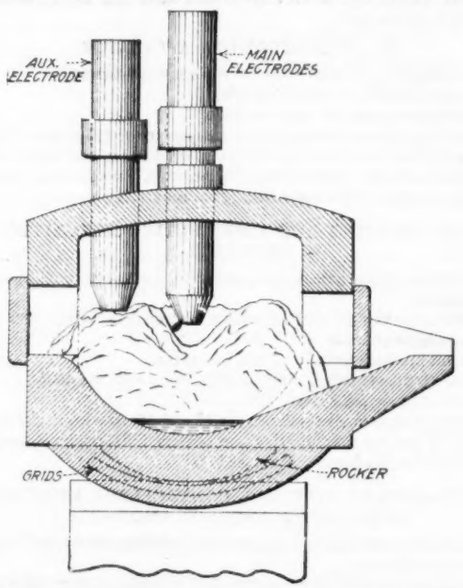



FIG. 1—PIECE OF METAL FALLING INTO PIT BORED BY ARC AND SHORT-CIRCUITING SAME

be kept hot enough between reversals of the current to serve as the cathode and so continuously maintain the arc. After a pool of molten metal has formed, however, with a quantity of slag, the arc will become quite steady.

(3) Pieces of scrap may fall against the electrode causing a temporary short-circuit surge, the duration of which will depend largely upon the size of the piece of scrap, the manner in which it rests against the electrode, and the time required for the electrode-raising mechanism or regulator to raise the electrode out of contact with the scrap. The reason for this is that, in melting, the electrode bores a hole down through the charge until a pool of metal forms upon the hearth of the furnace and the arc forms between the electrode and the pool of

*See "Electric Arcs," by Clement D. Child.

metal, the scrap gradually melting in from around the electrode. Sometimes pieces fall in and strike the electrode as shown in Fig. 1.

Therefore, it will be seen that during the first stages of melting, for perhaps the first half hour of the heat, there will be more or less current fluctuations due to the conditions in the furnace previously mentioned and the maximum value of such short-circuit currents will depend upon:

(1) The full load power factor of the electric furnaces and transformer equipment, that is the power factor of the furnace load measured at the high-tension busbars of the power supply.

(2) The low-tension voltage at which the furnace operates.

(3) The character of the scrap used in the furnace.

In Fig. 2 is shown a curve giving the ratio of the short-circuit current to the full-load current for various full-load power factors. This curve is based on the assumption, which is only approximately true, that on short circuit the resistance is practically zero and is simply an indication of the maximum current values

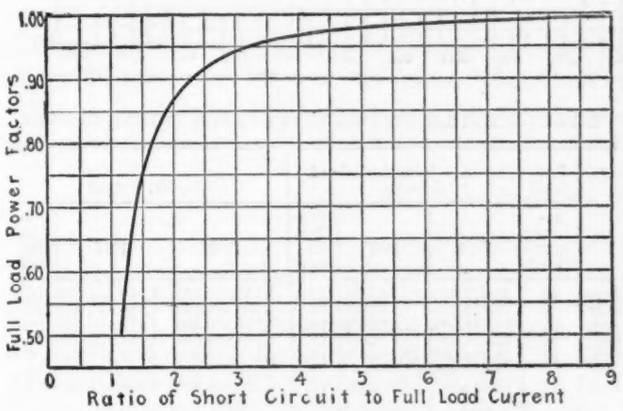



FIG. 2—INDICATION OF MAXIMUM SHORT-CIRCUIT CURRENT THAT CAN BE FORMED

which might be attained under certain conditions in the furnace. It is hardly necessary to give the detailed calculations, the points on the curve being computed from the fact that

Short-circuit current = full-load current ÷ sin $\theta$

where cos $\theta$ is the full-load power factor and the resistance on short circuit is assumed to be zero.

The resistance in the furnace may vary over a wide range depending upon the character of the scrap which forms the charge. For example, if the entire charge is composed of small scrap such as axle turnings, machine turnings or borings, the resistance to the passage of current will be very high, due to the large contact resistance between the large number of small pieces of scrap. Therefore, if the voltage applied to the furnace is low, the resistance offered by the scrap may be so great that there will be no short-circuit surge; in fact, no arc may form at all, and the furnace will not carry full-load current when the electrodes are first lowered, but only after a portion of the scrap has been heated by resistance and welded together will the resistance of the scrap be lessened to such an extent as to permit an arc to form. If the voltage applied to the furnace is considerably higher, there may be enough difference of potential to maintain the arc and also overcome the resistance of the small scrap so that the full-load current will flow when the electrodes are lowered. In this case the large resistance of the scrap would materially help to limit current surges in starting the furnace and much faster melting would take place at the beginning than with a lower voltage and no arc forming. In other words, with the same charge and 75 volts applied to the furnace, the entire 75 volts might be required to force full-load current through the resistance of the scrap. However, if the furnace voltage were 150, the resistance drop across the scrap might be about 75 volts and there would remain approximately 75 volts for the formation of the arc.

On the other hand, if the charge were composed of relatively large pieces of scrap, there would be little resistance drop in the charge, and the conditions would more nearly approach those shown in the curve of Fig. 2. It might be mentioned that, in order to limit short-circuit surges on starting and make an "easy" start, it is sometimes desirable to place the heavy scrap in the bottom of the furnace and cover it with a quantity of turning or other light scrap.

It is impracticable, however, to install an electric furnace under the conditions that only a certain kind of scrap be used, and the furnace must be capable of operating with the widest possible range of scrap materials. The voltage at which the furnace operates must also be such as to work efficiently under all conditions regardless of the quality of the scrap. Consequently the furnace must be designed to operate with a full-load power factor such that the highest possible current surges in starting will be limited to values which will not cause serious disturbance on the power lines.

Before the orders for the equipment for an electric furnace have been placed, a survey of the power conditions should be made by the engineers of the power company in conjunction with the electric furnace engineers and the electric furnace equipment then designed to operate with such a power factor as is suitable for the power company lines. Some of the factors which have to be determined are:

(1) Kva. generating capacity of the power company's station.

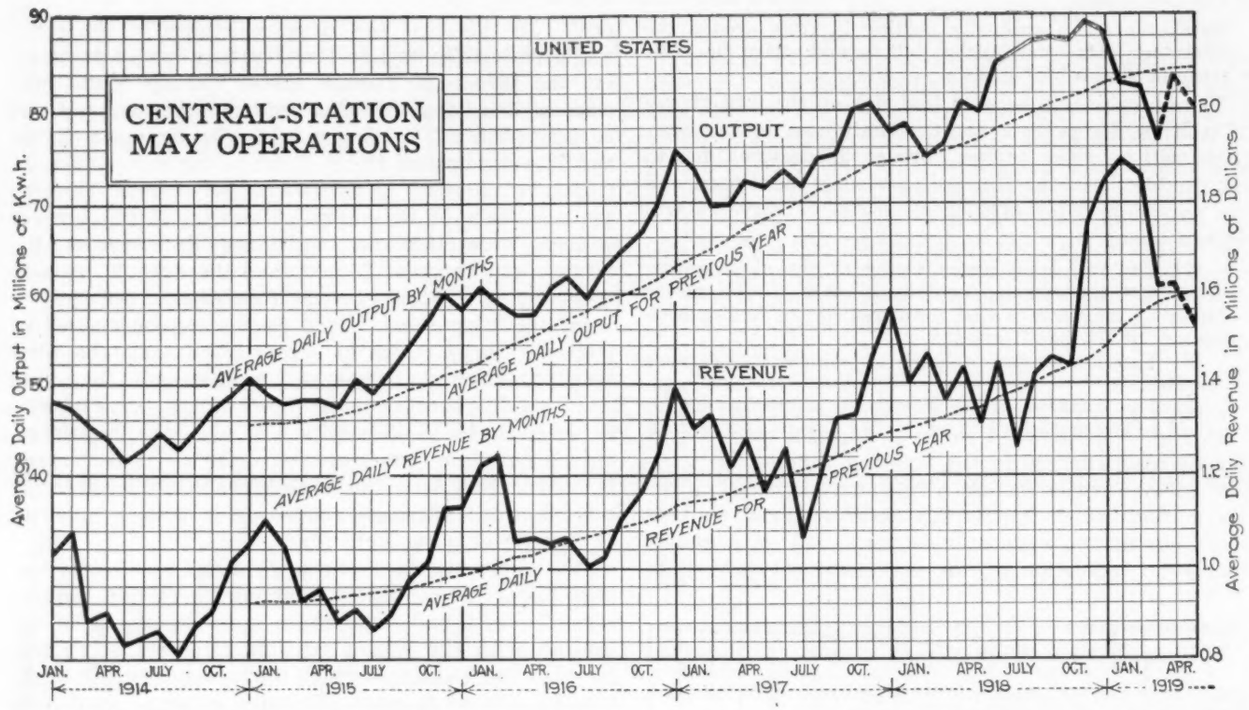
(2) Whether or not the power lines for the electric furnace run directly from the busbars of the generating station to the electric furnace substation, or run to an intermediate transformer substation of the power company. In the latter case it will be necessary to know the connected load on this transformer substation other than the electric furnace load and the character of this load.

(3) Whether or not a special line has been run from the generating station to handle electric furnace load, and if any other power service is taken from this line.

(4) If other power customers receive power from the same transmission line, it should be determined what the character of this load is and whether or not any portion of it consists of lighting.

(5) The approximate distance from the power station should be determined, as the reactance of the power lines can be taken into account in determining the characteristic at which it is decided for the electric furnace to operate.

If investigation of the foregoing subjects is made before the electric furnace user places his orders for the furnace and substation equipment, an electric furnace installation can be made which will cause little trouble to the power company and will frequently save a considerable expense that may develop if it is necessary to install additional equipment to cut down current surges after the furnace equipment is placed in operation.




THAT the readjustment to normal industrial conditions is proceeding rapidly and has perhaps already been largely accomplished is indicated by the returns of central-station operations received by the ELECTRICAL WORLD for the month of May. Even by that time the daily kilowatt-hour output had reached that of a year ago, when the industries of the country were producing to the maximum in the endeavor to meet war requirements.

The average daily output for May is but slightly lower than that indicated for April, as revised by the inclusion of additional reports. This decline is in harmony with the seasonal tendency. The increase in revenue over the corresponding month of last year, commented upon in previous reports, continued during

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

| | Percentage of Industry Represented | Revenue from the Sale of Energy | | | Kw.-Hr. Output | | |
|---|---|---|---|---|---|---|---|
| | | 1918 | 1917 | Per Cent Increase | 1918 | 1917 | Per Cent Increase |
| June | 60 | 26,070,000 | 22,599,000 | 15.3 | 1,531,099,000 | 1,319,444,000 | 16.0 |
| July | 56 | 21,935,000 | 18,559,000 | 18.2 | 1,370,461,000 | 1,156,692,000 | 18.5 |
| Aug. | 61 | 26,891,000 | 22,690,000 | 18.5 | 1,647,510,000 | 1,417,150,000 | 16.3 |
| Sept. | 60 | 28,051,000 | 23,810,000 | 17.8 | 1,579,149,000 | 1,348,820,000 | 17.0 |
| Oct. | 56 | 26,254,000 | 23,228,000 | 13.0 | 1,517,866,000 | 1,392,359,000 | 9.0 |
| Nov. | 57 | 29,883,000 | 25,894,000 | 15.4 | 1,528,836,000 | 1,383,747,000 | 10.5 |
| Dec. | 56 | 32,058,000 | 27,128,000 | 18.1 | 1,539,161,000 | 1,369,542,000 | 12.3 |
| | | 1919 | 1918 | | 1919 | 1918 | |
| Jan. | 57 | 33,294,000 | 27,589,000 | 20.6 | 1,522,660,000 | 1,357,460,000 | 12.1 |
| Feb. | 54 | 28,130,000 | 23,162,000 | 21.4 | 1,249,806,000 | 1,157,275,000 | 7.9 |
| Mar. | 57 | 28,569,000 | 24,420,000 | 16.8 | 1,357,981,000 | 1,341,374,000 | 1.2 |
| Apr. | 54 | 26,289,000 | 22,709,000 | 15.8 | 1,208,534,000 | 1,165,641,000 | 3.5 |
| May | 50 | 22,272,000 | 19,303,000 | 15.3 | 1,081,091,000 | 1,082,071,000 | —0.1 |

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

| | Month | New England States | | | | Atlantic States | | | | Central States | | | | Pacific and Mountain States | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Percentage of Industry Represented | 1918 | 1917 | Per Cent Increase | Percentage of Industry Represented | 1918 | 1917 | Per Cent Increase | Percentage of Industry Represented | 1918 | 1917 | Per Cent Increase | Percentage of Industry Represented | 1918 | 1917 | Per Cent Increase |
| REVENUE | June | 63 | $2,925,000 | $2,584,000 | 13.3 | 63 | $10,048,000 | $8,761,000 | 14.7 | 49 | $8,124,000 | $6,824,000 | 19.0 | 84 | $4,973,000 | $4,432,000 | 12.2 |
| | July | 62 | 3,037,000 | 2,511,000 | 20.9 | 62 | 9,278,000 | 7,961,000 | 16.5 | 42 | 4,998,000 | 4,116,000 | 21.4 | 88 | 4,622,000 | 3,971,000 | 16.4 |
| | Aug. | 63 | 3,138,000 | 2,585,000 | 21.4 | 63 | 10,147,000 | 8,722,000 | 16.3 | 51 | 8,223,000 | 6,823,000 | 20.5 | 85 | 5,383,000 | 4,560,000 | 18.0 |
| | Sept. | 64 | 3,268,000 | 2,811,000 | 16.2 | 57 | 10,143,000 | 8,631,000 | 17.5 | 51 | 9,251,000 | 7,703,000 | 20.1 | 86 | 5,389,000 | 4,665,000 | 15.5 |
| | Oct. | 63 | 3,360,000 | 3,036,000 | 10.6 | 51 | 8,822,000 | 7,924,000 | 11.3 | 50 | 9,218,000 | 7,848,000 | 17.4 | 81 | 4,854,000 | 4,420,000 | 9.8 |
| | Nov. | 64 | 3,695,000 | 3,238,000 | 14.1 | 55 | 11,877,000 | 10,400,000 | 14.2 | 50 | 9,277,000 | 7,704,000 | 20.4 | 81 | 5,034,000 | 4,552,000 | 10.6 |
| | Dec. | 64 | 4,097,000 | 3,449,000 | 18.7 | 55 | 11,927,000 | 10,199,000 | 16.9 | 50 | 10,781,000 | 8,836,000 | 22.0 | 79 | 5,253,000 | 4,644,000 | 13.1 |
| | | | 1919 | 1918 | | | 1919 | 1918 | | | 1919 | 1918 | | | 1919 | 1918 | |
| | Jan. | 63 | 4,253,000 | 3,443,000 | 23.5 | 60 | 13,444,000 | 11,168,000 | 20.3 | 47 | 10,410,000 | 8,484,000 | 22.7 | 77 | 5,187,000 | 4,494,000 | 15.4 |
| | Feb. | 63 | 3,895,000 | 3,048,000 | 27.7 | 53 | 10,894,000 | 8,943,000 | 21.8 | 45 | 9,305,000 | 7,484,000 | 24.3 | 73 | 4,036,000 | 3,618,000 | 11.5 |
| | March | 64 | 3,608,000 | 3,044,000 | 18.4 | 58 | 11,731,000 | 10,244,000 | 14.5 | . . | 9,012,000 | 7,447,000 | 21.0 | 81 | 4,218,000 | 3,685,000 | 14.4 |
| | April | 64 | 3,471,000 | 2,964,000 | 17.0 | 51 | 10,410,000 | 9,289,000 | 12.2 | 47 | 8,204,000 | 6,798,000 | 20.8 | 76 | 4,204,000 | 3,658,000 | 18.2 |
| | May | 57 | 2,987,000 | 2,603,000 | 14.9 | 45 | 8,204,000 | 7,320,000 | 12.2 | 44 | 6,514,000 | 5,417,000 | 20.2 | 70 | 4,567,000 | 3,963,000 | 15.4 |
| | | | 1918 | 1917 | | | 1918 | 1917 | | | 1918 | 1917 | | | 1918 | 1917 | |
| KW-HR. OUTPUT | June | 63 | 125,809,000 | 103,292,000 | 21.8 | 63 | 527,773,000 | 461,396,000 | 14.4 | 49 | 423,439,000 | 366,382,000 | 15.5 | 84 | 454,078,000 | 388,374,000 | 16.9 |
| | July | 62 | 135,960,000 | 105,373,000 | 29.0 | 62 | 518,566,000 | 439,464,000 | 18.0 | 42 | 254,189,000 | 216,296,000 | 17.5 | 88 | 461,746,000 | 395,559,000 | 16.7 |
| | Aug. | 63 | 143,566,000 | 114,017,000 | 25.9 | 63 | 567,672,000 | 490,505,000 | 15.7 | 51 | 447,829,000 | 399,278,000 | 12.1 | 85 | 488,433,000 | 413,350,000 | 18.1 |
| | Sept. | 64 | 133,901,000 | 114,279,000 | 17.1 | 57 | 520,312,000 | 445,154,000 | 16.8 | 51 | 471,594,000 | 408,320,000 | 15.5 | 86 | 453,342,000 | 381,067,000 | 18.9 |
| | Oct. | 63 | 139,784,000 | 128,970,000 | 8.3 | 51 | 481,222,000 | 440,268,000 | 9.3 | 50 | 479,990,000 | 442,054,000 | 8.5 | 81 | 416,870,000 | 381,067,000 | 9.4 |
| | Nov. | 64 | 138,559,000 | 123,033,000 | 12.6 | 55 | 542,699,000 | 495,812,000 | 9.4 | 50 | 444,012,000 | 396,665,000 | 11.9 | 81 | 403,566,000 | 368,237,000 | 9.6 |
| | Dec. | 64 | 145,543,000 | 129,838,000 | 12.1 | 55 | 405,253,000 | 421,973,000 | 12.6 | 50 | 489,864,000 | 443,544,000 | 10.4 | 79 | 428,906,000 | 374,187,000 | 14.6 |
| | | | 1919 | 1918 | | | 1919 | 1918 | | | 1919 | 1918 | | | 1919 | 1918 | |
| | Jan. | 63 | 143,254,000 | 124,632,000 | 14.9 | 60 | 525,322,000 | 458,545,000 | 14.5 | 47 | 463,394,000 | 403,127,000 | 14.9 | 77 | 390,690,000 | 371,156,000 | 57.2 |
| | Feb. | 63 | 128,660,000 | 109,993,000 | 17.0 | 53 | 406,702,000 | 374,958,000 | 8.4 | 45 | 426,965,000 | 378,912,000 | 12.6 | 73 | 287,479,000 | 293,492,000 | −2.0 |
| | March | 64 | 125,510,000 | 124,707,000 | 0.7 | 58 | 459,166,000 | 461,096,000 | −0.4 | 47 | 442,591,000 | 423,802,000 | 4.4 | 81 | 330,714,000 | 331,769,000 | −3.0 |
| | April | 64 | 123,211,000 | 118,322,000 | 4.1 | 51 | 382,282,000 | 369,701,000 | 3.4 | . . | 373,116,000 | 345,213,000 | 8.1 | 76 | 329,925,000 | 333,405,000 | −1.0 |
| | May | 57 | 114,490,000 | 114,532,000 | −0.1 | 45 | 302,037,000 | 315,315,000 | −4.2 | 44 | 324,427,000 | 309,928,000 | 5.2 | 70 | 340,137,000 | 342,296,000 | −0.6 |

May. In fact, the revenue for March, April and May was about 15 per cent greater than for the same three months of 1918, although the output was essentially the same. That this in some measure reflects increases in rates in many localities seems reasonable.

To indicate these various relations the ELECTRICAL WORLD shows graphically at the head of this report central-station operations for a period of five years. The units used in its preparation are estimated total daily output and estimated daily revenue, averaged not only for the month but also for the preceding twelve months. The heavier lines show the monthly fluctuations, while the lighter lines indicate the daily average for the preceding twelve-month period.

As might be expected in a period of industrial readjustment, there were wide local variations in the amount of power produced. In New England, which is essentially industrial, the returns generally indicate an output as great as that of a year ago and with only a slight decline from the April results, while in some manufacturing centers the output in May was substantially increased over that of April. The metropolitan district, including New York City, shows a drop from the April figures corresponding to the season. As a whole, however, the Atlantic section is the only one in which the output for May shows a material reduction over that of 1918. In the Central States the tendency is decidedly upward, the gains here offsetting the decline on the Atlantic Coast.

On the Pacific Coast the increase over April is quite striking. Reports from San Francisco indicate that the companies serving this district produced in May the largest output of any month in 1918 or 1919 and established a new record for energy production. The Mountain States, which had a decreased production of copper and other minerals, show a slight decline in output.

# Measuring Power Factor with Unbalanced Load

## Method of Securing Permanent Record of Maximum Value and Time of Occurrence — Weighted Value, the One Obtained, Is Most Important

BY WILLARD S. WILDER
The Milwaukee Electric Railway & Light Company

THE term power factor when applied to a polyphase system has no definite significance, as there is no single value of cos $\theta$ that will simultaneously express current and voltage relations in all phases of a three-phase circuit at the same time, unless perchance the angle of lag or lead be the same in each phase. Besides the power factor, or value cos $\theta$, for each phase is of little commercial importance, the weighted average of the power factor in all three phases being the value of significance and the one most easily measured. When the power factor of a polyphase circuit is expressed it is always this weighted average power factor that is referred to. This is the value of cos $\theta$ obtained by dividing the kilowatts power consumption by the kilovolt-amperes.

The method here developed requires two polyphase watt-hour meters, each with a demand indicator actuated from contacts in the watt-hour meter. If a customer has such a meter and demand indicator already installed, all that will be necessary is another meter and demand indicator. This last set can be conveniently mounted on a stand and carried from place to place as power factor records are desired. The customer's watt-hour meter or one of the test meters, if the customer's meter cannot be used, is connected in the standard way to measure power consumption, the demand indicator recording maximum power demands over short intervals of time, usually fifteen minutes. The other watt-hour meter is connected to measure a value proportional to the wattless component of power, its demand indicator recording the maximum wattless component of power over an equal interval of time.

The tangent of the angle of phase displacement $\theta$ is equal to sine $\theta$ divided by cosine $\theta$, or the wattless energy component divided by the power energy component. The charts obtained from the two demand indicators will give the maximum value of power and reactive power as well as their time of occurrence. The power factor of the circuit will be most objectionable when the value of tan $\theta$ is maximum; hence when the ratio between two demands taken at the same time on each instrument is greatest. This period can be quickly found from a short inspection of the charts. From a trigonometric table the value of cos $\theta$ or average power factor corresponding to this value of tan $\theta$ can be readily found. Not only is the maximum value of power factor readily obtained from the charts, but also any other value of power factor over any other demand interval. In case the weighted average power factor is desired over a greater period than the demand interval, the power consumption as read from the two meter dials can be used in the formulas and the weighted average power factor over any period of time determined. For the determination of instantaneous values of power factor, indicating polyphase wattmeters must be connected, as shown in Fig. 1, and simultaneous readings taken and substituted in the formulas.

Since the vector sum of the instantaneous currents is always zero for a three-phase system, the circuit can be treated as though the current in any supply main equaled the sum of those in the other two mains.

The currents in the mains differ by 30 deg. from those in the delta system and are $\sqrt{3}$ times as great as the current in any delta branch, or equal to the vector difference of the currents in the two delta branches connected to it. In other words

$$I_a = i_1 - i_3 \quad (1)$$

$$I_c = i_2 - i_3 \quad (2)$$

The total power in the circuit is thus equal to that in phase *A* plus that in phase *C*.

The power in phase $A$ is

$$P_a = E_{ab}\, I_a \cos\,(30 + \alpha) \qquad (3)$$

and in phase $C$ is

$$P_c = E_{cb}\, I_c \cos\,(30 - \beta) \qquad (4)$$

Since a polypase meter is employed it records the sum of the power in the two elements ($P_a \times P_c$), the total polyphase power in the circuit whether the loads

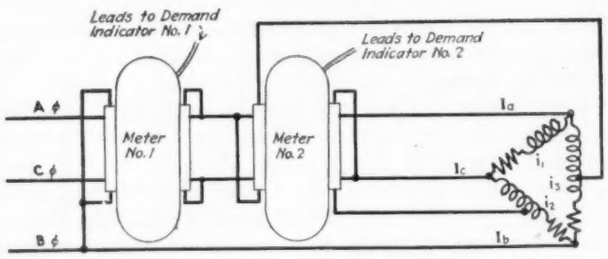



FIG. 1—CONNECTIONS OF TWO POLYPHASE WATT-HOUR METERS TO MEASURE POWER AND WATTLESS POWER OF SAME CIRCUIT

are balanced or not. Similar expressions for $P_a$ and $P_c$ will be obtained from a Y-connected load, for then the main voltages will differ in phase by 30 deg. and be $\sqrt{3}$ times the $Y$ voltages, resulting in formulas of the same magnitude as equations (3) and (4).

For balanced conditions

$$E_{ab} = E_{cb} = E_\triangle \qquad I_a = I_c = I_y \qquad \alpha = \beta = \theta$$

and

$$P = E_\triangle I_y\,[\cos\,(30 + \theta) + \cos\,(30 - \theta)]$$
$$= \sqrt{3}\, E_\triangle I_y \cos\theta \qquad (5)$$

The power factor is

$$\cos\theta = P/(\sqrt{3} E_\triangle I_y) = P/(E_y\, I_y) \qquad (6)$$

Since

$$I_y = \sqrt{3}\, I_\triangle \text{ and } E_y = E_\triangle/\sqrt{3}$$

Formula (6) when used in determining the power factor of an unbalanced load gives a value of cos $\theta$ equal to the weighted average of the power factor in all three phases. This formula to be of value presupposes a knowledge of the current values not easily obtained.

As in meter I, the main currents in the meter elements are $I_a$ and $I_c$. The potential for the element in phase $A$ is connected with reversed polarity between phase $C$ and a point midway between $A$ and $B$. The potential for the elements in phase $C$ is connected between phase $A$ and a point midway between $C$ and $B$. These points of potential midway between phases can be obtained from middle taps on potential transformers, a middle tap of a balancing coil or between two electric lamps connected across phases. $E'$ is the potential of the element having current coil in phase $A$ and $E''$ the potential of the element having current coil in phase $C$. The potentials in meter II lag 90 deg. behind those in meter I, with the result that meter II measures quadrature or wattless power. The total quadrature power of the circuit is proportional to that recorded by meter II or $(P'_a + P'_c)$.

$$P'_a = E'\, I_a \cos\,[90 - (30 + \alpha)]$$
$$= E'\, I_a \sin\,(\alpha + 30) \qquad (7)$$
$$P'_c = E''\, I_c \cos\,[90 + (30 - \beta)]$$
$$= E''\, I_c \sin\,(\beta - 30) \qquad (8)$$

For balanced conditions

$$E' = E'' = E_\triangle \sin 60^\circ = 0.866 E_\triangle \qquad I_a = I_c = I_y$$

$$\alpha = \beta = \theta$$

and

$$P' = P'_a + P'_c = 0.866 E_\triangle I_y\,[\sin\,(\theta + 30) + \sin\,(\theta - 30)] = 1.50\, E_\triangle I_y \sin\theta \qquad (9)$$

Equation (9) is the value registered by meter II. The wattless component of power is $\sqrt{3}\, E_\triangle I_y \sin\theta$, or 1.15 times the registration of meter II (equation 9).

$\tan\theta = \sin\theta/\cos\theta = (\sqrt{3}\, E_\triangle I_y \sin\theta)\ /\ (\sqrt{3}\, E_\triangle I_y \cos\theta)$ = (1.15 times registration meter II) ÷ (registration meter I). (10)

Since the currents in both meters bear the same relations whether the loads are balanced or unbalanced and since both meters record in the same proportion on unbalanced as well as balanced loads, the value of cos $\theta$ or power factor obtained from equation (10) will be the weighted average power factor of the polyphase circuit.

If the multiplying constant for both meters is the same, the tangent of the angle of phase displacement will be 1.15 times the reading of meter II divided by the reading of meter I. Where different multiplying constants are employed for each meter, because of differences in instrument transformers or meter constants, the readings must be first reduced to the same units before taking their ratio. The two demand indicators record proportional to the meter disk revolutions over the demand interval, hence these readings measure power and reactive power in the same proportion as the watt-hour meters. Periods where the ratio between two similar demands on the charts is greatest will give the largest value of tan $\theta$ and the value of cos $\theta$ or power factor will be most objectionable. Knowing tan $\theta$, the value of cos $\theta$ or power factor can be readily determined from a trigonometric table, or if desired the angle of average phase displacement $\theta$ can be found.

In connecting the meters it is best to connect meter I first, placing current elements of meter II in series

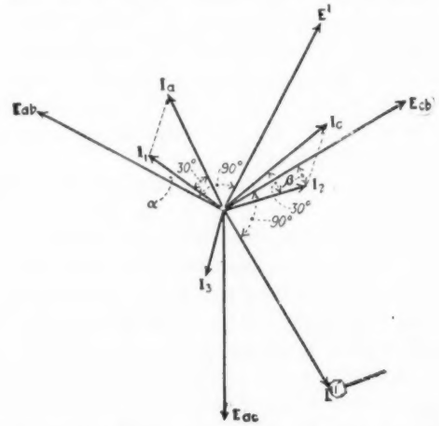



FIG. 2—VECTOR RELATIONS OF CURRENT AND VOLTAGE IN METERS I AND II, WITH CONNECTIONS SHOWN IN FIG. 1

with similar elements of meter I. The potential coils of meter II should then be connected in the correct phases, proper polarity being that which gives the maximum positive reading or disk speed of meter II. If this precaution is followed, no difficulty should be experienced in properly connecting the meters, even if current and potential transformers complicate the connections.

# Proposed Changes in A. I. E. E. Activities

## Suggestions Made by Development Committee of the Institute and Comments of Members Who Have Studied Them—Danger Seen in Downward Change of Institute Standards and Activities in Engineering and Research

AT THE thirty-fifth annual meeting of the American Institute of Electrical Engineers at Lake Placid, N. Y., June 24-27, its development committee proposed changes in the character and functions of the Institute *Proceedings* and other activities which provoked considerable discussion at two long sessions. Details of the points brought up in discussion appeared in the report of the Lake Placid meeting published in the ELECTRICAL WORLD for July 5, pages 16 to 19.

### CHANGES PROPOSED BY DEVELOPMENT COMMITTEE

The changes proposed by the development committee as presented at the Lake Placid meeting are as follows:

I. PUBLICATION.

(a) Entirely change the character and form of the monthly publication by adopting the so-called standard technical publication size (9 in. by 12 in.), enlarging the editorial and executive publication staff, and make every effort to develop this publication into the best possible engineering magazine without in any way lowering the Institute's standards.

(b) Eliminate therefrom the publication of papers except Institute and occasional papers of unusual broad general interest or value. Substitute a set of abstracts of perhaps one-half page each of every paper presented to every section so that each month there will be a complete record of this class of Institute activity.

(c) (New clause.) Print the *Proceedings* in two sections bound together into one publication when issued but so arranged that they may be later separated by the recipient who may wish to dispense with that part made up of temporary matter and retain that part containing matter of permanent value. Publish in later issues of the *Proceedings* all discussions of papers previously appearing in full.

NOTE.—The cost of printing, binding and distributing *Annual Transactions* now averages $18,000. It is thought that this amount of money can be expended with better results to the membership if the above plan will be acceptable to the membership in lieu of the present practice.

(d) Substitute for (c): Create a special committee which, after a definite general publication policy shall have been adopted, shall study all questions concerning the publication, free distribution, sale, etc., of papers not printed in the *Proceedings*.

(e) Formerly (d): Employ as a part of the magazine staff the best advertising solicitors obtainable and endeavor to make the publication a large earner. With the example of the American Society of Mechanical Engineers and the National Geographic Society before us, it is believed that a substantial profit can in time be realized by this means, and, if so, it is proposed to allocate a liberal part of such profit pro rata to the various sections.

II. ORGANIZATIONS.

(a) Create a New York section, to be organized and conducted on the same lines as existing sections elsewhere.

(b) Discontinue holding monthly Institute meetings in New York and inaugurate the policy of holding Institute and directors' meetings successively in different parts of the country where local sections are established. It may be desirable to reduce the frequency of Institute and directors' meetings and hold them every two months or perhaps even less frequently instead of every month as now.

(c) Divide the country into geographical divisions corresponding in number to the number of Institute vice-presidents. If more than six divisions should be thought desirable, they should be established and the number of vice-presidents increased to correspond. In order to allow for the future shifting of membership density and at the same time to escape the necessity of cumbersome constitutional amendments, the number and delimitation of geographical divisions should be specified in the by-laws instead of the constitution, to provide for ready amendment by the board of directors.

(d) Select one vice-president from each geographical division. Continue to elect the president and managers from the membership at large as at present.

NOTE.—The legality of electing directors to an organization chartered under the New York State law in any other way than by the vote of the entire membership is being investigated by counsel.

(e) Pay the traveling and living expenses of the officers and board members when attending Institute meetings. It is hoped that by the payment of these expenses and by a reduction in the number of Institute meetings held each year a full attendance can be secured and all parts of the country be better represented.

(f) Make it the duty of each vice-president to visit the sections in his own division at least once a year. Of course, it would also be desirable if the vice-presidents could exchange visits.

(g) (New section.) Increase the vice-presidents' term of office from one year to two years and remove the constitutional inhibition against the election of a vice-president as manager. Provide against perpetual tenure of office by a constitutional provision that, except in the case of a manager or a vice-president who may be elected president, no member may continuously hold office longer than for six years.

III. ACTIVITIES.

(a) Decentralize committee work as far as it may be found feasible and desirable by substituting section committees for Institute committees. Appoint a general committee to study this question and make recommendations.

(b) Present more high-grade papers of general engineering interest.

NOTE.—The clause as originally worded gave the impression that the standard of the Institute papers was to be lowered instead of broadened.

(c) Create a committee in each section charged with the duty of assigning to the younger members specific participation in designated meetings by the preparation of papers, discussion or otherwise. It is hoped by this means and by the appointment of a reasonable number of the younger men to the larger committee membership caused by decentralization that the interest of the younger men will be stimulated and their loyalty increased.

IV. LOCAL FEDERATION.

(a) Prepare a comprehensive but flexible uniform outline for the federation of local engineering bodies, taking advantage of the experience already gained by existing affiliations.

(b) Use our endeavors to have the other national societies establish and support local sections along lines similar to ours, but do not confine local federations to such branches, rather planning to include all the worthy engineering bodies.

(c) Wherever such federation can be organized, establish under an appropriate name a federated local council of engineers to be made up of a properly apportioned number of representatives from the different locals.

V. NATIONAL COUNCIL.

(a) Establish a direct touch between each local federated council and a National Engineering Council composed of delegates from as many national engineering societies as are willing and worthy to participate.

(b) Through the medium of the national and the local

federated councils perfect a working arrangement for engineering coöperation in all public affairs where such is desirable. The proposed plan of federation will perhaps be made more clear by the attached diagram.

VI. ENGINEERING CONGRESS.

Endeavor to inaugurate the custom of periodically holding an engineering congress, the delegates to which should be selected from all parts of the country under a plan to be developed for suitable representation, this congress to consider and take action on such matters of general interest to engineers and to the public as may merit its attention and as have been previously advertised for a sufficient length of time to permit locals everywhere to give them consideration and when possible to send instructed delegates.

NOTE.—Many suggestions have been offered regarding the details to be considered in carrying out the plan outlined in Sections IV, V and VI, but inasmuch as progress can be made only by and with the coöperation of the other founder societies, it has been thought best not to attempt to specify details in our recommendations, but having expressed approval of the general plan outlined, to leave the working out of such details to our conferees.

### DEVELOPMENT WORK OF CIVIL ENGINEERS

All of the four founder societies of electrical, mechanical, civil and mining engineers have appointed development committees to examine carefully the relations of their various organizations to members, to other organizations and to the public. It is from the American Society of Civil Engineers that the A. I. E. E. patterned the objects of its development committee work as outlined in the March, 1919, issue of the *Proceedings*, pages 87-88. In this connection, therefore, the comments of Dr. Charles Warren Hunt presented at a meeting of the development committee of the American Society of Civil Engineers of June 13, based upon twenty-seven years' service as secretary of that society, are of interest:

If I am not very much mistaken, the orginial idea of the development committee of the American Society of Civil Engineers was the development of the society itself to meet existing and changed conditions due to the war, etc., and that to its duties was added later the question of coöperation with other bodies for the general good.

I have not been asked, as I understand it, to come here with any suggestion as to improvement in methods of the society's work, nor do I know to what extent the committee has decided on suggesting fundamental changes, but I believe that it is entirely proper for me to discuss that part of the problem which relates to the coöperation between organizations, inasmuch as that has nothing whatever to do with the management of the American Society of Civil Engineers. I have therefore ventured to write out, as briefly as possible, a statement of my views, based upon a great deal of careful thought and considerable knowledge of conditions both at headquarters and in various parts of the country.

There are, in my judgment, two entirely separate phases of the general subject of the condition of the engineering profession:

(1) The theoretical, scientific, educational side, which includes the maintenance of high professional and ethical standards, and

(2) The welfare side, which includes all matters relating to the profession outside of those in No. 1. This means not only the participation of the engineer in civic and community affairs, but concerted action connected with national, state and municipal problems, in which the welfare of the members of the profession both individually and collectively is concerned, such as professional rates of pay, employment of engineers and all legislation which affects the profession either locally or nationally.

In my opinion, these two lines of effort cannot be carried on together. The national engineering societies are well organized for, and can carry on, the first of these, and they should not be interfered with nor hampered by being forced to undertake the second.

If this be true, then the problem is so to organize the engineers of the country that they may be able to handle both national and local matters concerning the welfare of the profession. My experience is that the chief difficulty in the attempts which have been made up to the present time in coöperation among various groups of engineers is that we have been trying to work from the top down and not from the bottom up. I think that true coöperation must have its source in the individual, or in smaller geographical groups of individuals, which groups shall elect representatives and instruct them as to the lines on which they wish coöperative effort made. They must also finance that effort in proportion to the numerical strength of each sectional or geographical group.

Dr. Hunt then outlined in detail the possible organization of local associations and their relationship to a truly representative body, which he characterized as an Engineering Council.

### COMMENTS ON FUNCTIONS OF A. I. E. E.

On account of the differences in opinion which were distinctly evident in the discussion at the Lake Placid meeting, due no doubt to lack of knowledge of the proposed changes, which were merely submitted in mimeograph form, and to the desire expressed by many A. I. E. E. members for fuller publicity on the whole matter, the ELECTRICAL WORLD has opened its columns for general discussion. It is hoped that through this means all of the facts involved may be brought to light and no changes hurriedly made which will not be to the best interests of the electrical engineering profession.

Comments from some members of the A. I. E. E. who have been approached by the ELECTRICAL WORLD are appended hereto, including an extended discussion by Dr. Charles P. Steinmetz.

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## "Young Engineers Interested in High Standards," Says Prof. Dugald C. Jackson

*To the Editor of the* ELECTRICAL WORLD:

SIR: I have not read the report of the development committee to which your letter particularly refers and therefore am not prepared to express an opinion upon its features; but there is one point that ought never to be lost sight of, and I am therefore going to emphasize it to you, namely, that the younger engineers are generally as much interested as the older engineers in the papers written by masters and which punctuate the course of the development of the art. It is this kind of paper which has given the *Transactions* of the American Institute of Electrical Engineers their great standing, and the value of the *Transactions* in the eyes of the young electrical engineers as well as the old electrical engineers has largely been established and maintained by papers of this nature. No volume of the *Transactions* during the thirty-five years of the existence of the Institute has been without a considerable proportion of such papers. Without them the *Transactions* would have only an ephemeral value and the Institute would have correspondingly less influence. I doubt whether without them the Institute would have reached its present numerical membership.

If this conclusion of mine is correct, a modification of publication plans is likely to be disadvantageous rather than advantageous. DUGALD C. JACKSON.

Cambridge, Mass.

# Enhancing the Prestige of the Institute

## Activities Which Should and Which Should Not Be Undertaken—Original Professional Papers and Reviews of the State of the Art Desirable—Comments on Institute Publications

BY DR. CHARLES P. STEINMETZ

ORIGINALLY, the American Institute of Electrical Engineers was the parent electrical engineering society. Then the American Electrochemical Society was formed, the Illuminating Engineering Society, etc. To stop this centrifugal tendency, the technical committees were established. They have been a very valuable asset, but in their intended purpose they failed and had to fail. The field of electrical engineering has become so enormous that specialization became inevitable; the amount of time and activity which the A. I. E. E. can devote to each branch of electrical engineering necessarily is very limited and less than the electrical engineer specializing in this branch requires. Thus special electrical engineering societies became necessary and were formed.

We have now a large number of electrical engineering societies, each reading papers, issuing proceedings and transactions. Even aside from the financial burden of belonging to all these electrical societies, it has become practically impossible for any engineer to read, study and digest all the publications of all the electrical engineering societies. But without keeping informed on the progress of electrical engineering in all branches outside of his own specialty, with the present rapid progress, the electrical engineer very soon drops behind in all but his own specialty—becomes a back number.

This is the most serious aspect of the present situation; it is the greatest problem before the engineering world to-day, and it is in this where the A. I. E. E. could be of the greatest value to the electrical engineering profession:

"To resume its position of parent electrical engineering society, by devising a method of coöperation and affiliation with the other electrical engineering societies, whereby the work done by all these societies is made accessible and available to all the engineers, and to supply the information whereby the individual engineer could keep generally informed and up to date in all branches of electrical engineering."

### IMPORTANT INSTITUTE ACTIVITIES

Of the activities of the A. I. E. E. the publication of transactions and proceedings is the only one which reaches all the members. Probably for more than three-quarters of the members the receipt of its publications is the only thing they get out of the Institute and the only thing they care for. The Institute publications therefore are the last activity in which retrenchment should be considered, and curtailment in this direction would be suicidal.

Next in importance are the local activities, in sections, branches, etc. It must be realized, however, that, after all, it is only a small minority, mainly of the younger membership, which participates in this, and even then only temporarily, and the general experience is that after a few years of local activity the members drop out into that big majority who do not care to take an active part, do not vote for officers or referendum, do not respond when the membership is asked to express opinions on proposed changes, but belong to the Institute as long as they consider it worth while and silently drop out when they feel that what they get from the Institute is not worth the membership. But it is this mass of members which gives the Institute the stength and prestige, because most of the older and more prominent engineers belong to it.

Third only in importance are the activities centering around New York, the engineering building, etc. Even the engineering library, which is probably the most valuable asset of the Institute, probably has not been used by one out of every ten members.

Decidedly inappropriate, however, in my opinion, are any social, industrial, economical or political activities of the Institute (unless definitely authorized by a clear referendum vote, such as its stand for the metric system). However much we all agree that the engineer should take an active part in the world's activities, the Institute officers are chosen solely because they are prominent electrical engineers, without regard to their views in other matters, and thus cannot represent the membership in such other matters, and it cannot even be claimed that the views of the officers in matters outside of engineering probably are representative of the views of the engineers at large, for the officers are chosen from that small minority which have become prominent as engineers.

Herefrom it follows that when considering the problem of making the A. I. E. E. more valuable to its members and to the engineers at large, and thereby to the public, the main effort must be concentrated on improving the value of the Institute publications, as the most important and the only all-embracing activity.

What should the publications of the Institute, papers, committee reports, etc., contain?

(A) A report, and preferably the first report, of every important advance in the field of electrical engineering, preferably by a paper from the engineer who has been instrumental in this advance.

(B) A complete but concise annual report of the contemporaneous history of electrical engineering; that is, a review of the state of the art in all its branches.

(C) An abstract or syllabus of the literature on electrical engineering, so far as it deals with original subjects, and more particularly of the papers and other publications of other electrical societies.

### ORIGINAL PAPERS DESIRABLE

(A) Comprises the three successive steps of development:

1. Original papers on theoretical or experimental investigations in electrical engineering and the sciences underlying it.

In this aspect the situation is fairly satisfactory, and we get most of these papers. All that is needed is more systematizing and to impress upon the engineering fraternity that it is their duty to publish through the

*Transactions*, as well as that by publication in the *Transactions* they reach the widest engineering and scientific circles in the shortest time, and that engineers and scientists as a matter of course look to the *Transactions* for the original record of all theoretical and experimental advances.

In presenting such papers it must be considered that there can be little oral discussion, but intelligent discussion must be in writing; thus the meeting time devoted to such papers may economically be shortened.

2. Original papers on all important inventions, discoveries and developments. Here also the Institute is becoming increasingly successful, though some important inventions and developments have been given to the world first through societies of a more commercial nature.

3. Reports on all important new installations, methods of operations, etc., preferably by papers from the engineers who have done the work. I do not mean all new installations, but those which represent an important step in advance, such as that at the Fiske Street station in Chicago when first the large steam turbine was made the prime mover; the development of the power-limiting reactance, which has made the operation of the modern huge electric station possible, and its why and wherefore; the electric drive of battleships and its engineering problems, etc.

It cannot be denied that in this field the Institute records have been and are rather deficient, and apparently no systematic and permanent endeavor is made by the Institute to obtain these papers, nor is there among the Institute papers and the engineeers at large the same conception that such papers belong to the Institute and are desired and solicited.

It must be realized that the final application of the engineering knowledge in the design of electric installation, or in the method of operation which makes it successful, is just as important a step as the theoretical or experimental investigation which originally gathered the knowledge and the invention or development which applied it to concrete apparatus.

A greater effort in this direction would make the *Transactions* far more valuable, and the deficiency in this direction appears to me a just cause for criticism.

### Review of State of the Art

(B) Periodic reports on the state of the art. The necessity for this I have stated above—the increasing specialization of the electrical engineer and the correspondingly increased difficulty of keeping up to date in all branches of electrical engineering without some such means of obtaining a general review.

When I had the honor of being president I introduced such a periodic review of the state of the art by papers and topical discussions, but afterward it was allowed to lapse, probably owing to the non-existence of the technical committees at that time. This work should be under the direction of the technical committees. The experience of other societies, such as the Association of Edison Illuminating Companies, the National Electric Light Association, etc., has shown that the committee reports giving the state of the art are one of the most important and extensive activities, and if this is the case in these societies, how much more should it be so with the A. I. E. E., with its far wider scope of interest!

To accomplish this object the committee reports must not be merely a tabulation of the advance, but should be an explanation and description which, however short and concise, is sufficiently explicit and detailed to keep the engineer up to date in those branches which are outside his specialty. This would require a reorganization of the committees, making them essentially working committees rather than honorary committees, composed of a small number of members who can and are willing to devote considerable time to the committee work. The members of the committees should remain largely the same from year to year, so that they can systematically organize the work and take a permanent interest and responsibility in it, as is the case in other societies. Some financial contributions might also be necessary to enable the committees to employ assistance.

### Committee Reports Insufficient

However, committee reports alone are not sufficient. Equally essential are papers and topical discussions by the leaders in the field. Only thereby can a live representation of the state of the art be obtained, giving the different viewpoints, the work which is going on, its future prospects, etc.

Thus, instead of appointing a large unmber of prominent engineers on the committees, we should induce these engineers to give papers, even if only short ones, reviewing the state of the art within their field of activity, dwelling on their work and its aspects, etc., or at least to take part in a topical discussion. Then at a meeting or convention devoted to this branch of electrical engineering, and under the auspices of the respective technical committee, all these papers and topical discussions would be represented and discussed, together with the committee report.

Meetings have heretofore been arranged by technical committees, but almost invariably one or two original papers have been presented on some special subject, rather than a complete review of the entire field of engineering covered by the committee, and it is the latter feature which would render the committee of greatest value to the Institute. Special papers of type A might be secured by the technical committees, but would preferably be turned over to the general papers committee.

As stated, this activity has been almost entirely neglected by the Institute. It is the one by which it would be of most value to all the engineers, and it should therefore be organized and pushed, the more so as it would not involve any material increase of expenditure, though it means much more work for the committees, and more work to select efficient committees and to direct them. I believe the management of the Institute could in no direction be of more use to the membership than by devoting its time and energy to the organization of such committee work.

It is doubtful whether the presentation of the committee reports at the annual conventions is desirable, as there are so many that usually there can be no adequate discussion. Moreover, fewer but better committees would be preferable.

### Résumé of Contemporaneous Literature

(C) Make available and accessible to the Institute members the work done by all the other electrical engineering societies, and in general the contemporaneous literature.

For the present, and for some time to come, I would

limit this to publication of abstracts of all the papers and reports published by the other electrical engineering societies. An ordinary digest, made by a reviewing committee, is not satisfactory for this purpose. No matter how competent the abstractor, such digest contains what the abstractor considers as the important and essential part of the paper, rather than what the author desires to convey by it, and there often is a very material difference. Otherwise there would not be such urgent need for such abstracting service, inasmuch as several very good digests are being published, for instance by the ELECTRICAL WORLD and by the British Institution of Electrical Engineers. Such abstracts as those advocated must be made by the author of the paper, under the direction of an abstracting committee.

### AFFILIATED SOCIETY PUBLICATIONS

My recommendation would be to organize a method of coöperation with the other engineering societies which cover electrical engineering and similar fields—such as illuminating engineering, electrochemistry, radio communications, etc.—whereby these societies will agree to ask from the author, when he submits a paper, a syllabus of about 5 to 20 per cent of the length of the paper, made in accordance with the regulations, acceptable to the abstracting committee and edited by it. A member of the papers committee of each of the affiliated societies would be appointed to the abstracting committee, and a member of the A. I. E. E. abstracting committee would be appointed to the papers committee of each of the affiliated societies (wherever feasible members of both societies would obviously be chosen for these positions). The abstracting committee would consist of very few active members, who would have to devote considerable time to the work and therefore might have to be compensated, and a large number of consulting members chosen from the prominent engineers of all branches.

It might be feasible to come to an agreement with the affiliated societies to adopt a uniform size of proceedings, so that a stereotype plate of the syllabus of the paper could be used for the abstract and the expense thereby materially reduced.

The Institute now demands such syllabuses, but apparently little supervision is exercised over them, and thus, while some are good, many are bad or indifferent. A way of finding out whether a syllabus is satisfactory is by judging the acceptability of the paper by the syllabus, using the text of the paper merely for reviewing the decision. If the syllabus is what it should be, it must be possible to judge the contents of the paper by means of it.

Such an arrangement with the other societies in their most important activity would reëstablish the A. I. E. E. as the parent society and would be of immense value to all the societies within the affiliation by making available to their members the work of all the societies. No society could therefore remain outside of the affiliation, and the plan would permit the necessary and thus unavoidable formation of special societies for different branches of electrical engineering to be carried on without the present harmful decentralization.

### OBJECTIONS TO CHANGES IN TRANSACTIONS

As regards the concrete proposal of the report of the committee on development:

1. The discontinuance of the annual *Transactions*, which is not definitely recommended but merely thrown out as a feeler, in my opinion would be suicidal. The standing and prestige of the Institute—as distinguished from the clamor of the masses—entirely depends on its permanent work, and the *Transactions* are the record and foundation thereof. Thus no question of economy would justify their discontinuance—directly, or indirectly by requiring the members specifically to write and ask for them, or any other such method.

With regard to the "younger engineer," so much quoted as demanding light popular reading matter in the *Transactions*, I am convinced that the young graduates of our present high-grade electrical engineering schools are the last men afraid of a few theoretical or even mathematical discussions.

Monthly publications obviously also must remain, as the members cannot be expected to wait a year or more before receiving the papers. To expect them to write and ask for individual papers is impracticable. They would not do so, but would simply lose interest and drop out of the Institute.

On the other hand, it must be realized that we did not always publish monthly and annually in duplicate; but for many years the *Proceedings* were issued monthly, and at the end of the year the secretary wrote the members and requested them to return the *Proceedings* to have them bound by the Institute, and, if they did not care to do this, supplied them with folders to hold the *Proceedings*. The objection to this plan was that the discussions were scattered throughout the text. This, however, could be obviated by printing the monthly *Proceedings* in four separate sections, separately paged and loosely pasted together—the first one containing the announcements and temporary news, to be thrown away at the end of the year; the second containing the papers; the third one the discussions, in the same consecutive order as the papers in the second section, and the fourth containing the abstracts of all the papers presented before the association of affiliated societies, as discussed above.

The monthly *Proceedings* could then be pulled apart and rearranged for binding without reprinting. Any lost or otherwise missing copies could be replaced by the Institute in binding, under the same liberal policies as formerly.

### COMPETITION WITH TECHNICAL PRESS

2. Making money by extensive advertising in the *Proceedings*. There is something ethically unsatisfactory in this proposition. There is no need or demand for an additional technical advertising medium. All desired advertising is amply taken care of by the technical press and the home publications of the advertiser. Thus in developing an additional advertising medium we would not be "giving needed service," and there would be a feeling that the prestige of the Institute is used to get contributions. There also is the danger, as soon as we depend to a considerable extent on the income from advertisers, of losing our independence because of commercial interests; and the present proposition of changing the size of the *Proceedings* from the standard of thirty-five years to one more desirable for the advertiser bodes ill in this direction.

In most other respects the proposed larger size of the *Proceedings* appears undesirable. It is more inconvenient to carry about, to read on cars or in other spare moments. In mailing the pages are more liable to be

rolled or bent or folded and thereby to arrive in an unsightly condition, as do the present *Proceedings* of the A. S. M. E. This would mitigate against keeping the *Proceedings* for filing or record, etc.

COMMENDABLE CHANGES

3. The recommendations to pay the administrative officers traveling expenses, to have the vice-presidents locally elected as territorial representatives and to have the board meetings less frequent are highly to be approved and appear to me very necessary to safeguard the independence of the Institute and to avoid excluding from administration many of our best members. Our country is so large and its interests are so diversified that it is not healthy for a national organization to have its governing body almost entirely composed of members from New York and vicinity. But the directors must be chosen so that they can attend the board meetings, and at present from the South, the West and the Middle West only those few can attend who are very well-to-do or whose traveling expenses and time are contributed by some corporation.

4. The recommendation of more extended local organizations, and of arranging for federating the local engineering organizations outside of the Institute, is also very much to be favored. To assure the engineer his position in society requires organization, local and national, to deal with the matters of interest to the engineer in social, industrial, economical and political activities. However, many differences of opinion exist, and these differences tend to become more accentuated, and therefore it is very desirable to keep such activities out of the Institute proper, leaving the latter in charge of the fields in which there can be universal agreement, that is, science and engineering.

In general, the report of the development committee appears to me very admirable and praiseworthy in everything it deals with, except with regard to the question of Institute publications and matters pertaining thereto, in which it appears to me weak and not to touch the core of the problem.

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## Work of A. I. E. E. Development Committee Summarized

*To the Editor of the* ELECTRICAL WORLD:

SIR: I have your communication of July 3, with accompanying clipping from the ELECTRICAL WORLD covering the A. I. E. E. convention at Lake Placid, and wish to tender you my thanks therefor. I desire also to comment on what you call a singular manner of presenting the report of the development committee. I fear that, notwithstanding a great deal of publicity which has been given this matter, the whole thing has been very much misunderstood by some individuals, and I am inclined to believe particularly so by those who were at the convention but had not previous to that time participated in any of this work. Let me briefly review the situation.

The president appointed a development committee, and therefrom an executive committee similar to the committees appointed by other technical societies, to canvass activities and suggest any desired modifications which seem desirable to improve the value of the Institute to its members and to the community in which it is placed. As a means of obtaining the desired end the committee requested all sections to nominate a member for the development committee, and the committee thus constituted was the most representative of the membership which could probably have been obtained. These committeemen then worked through their sections and obtained as accurately as possible the consensus of opinion of their constituents and supplied the development committee with suggestions for changes, together with a variety of opinions. This matter was turned over to the executive committee and carefully sifted and condensed into a report which was presented at a combined meeting of the section delegates and the development committee on Wednesday at the convention. This committee, after making slight changes, formally adopted the draft of report which had been prepared by the executive committee. On the following day this report was presented at an open meeting.

Two things should be borne in mind, the first and foremost of which is that this was the best expression of opinion of the members of the A. I. E. E. that could be obtained by the committee; secondly, it was not presented at this open meeting for any particular indorsement or approval. Hence your argument that but few mimeograph copies were circulated and that there appeared to be an undue effort to push the thing through the meeting cannot hold. That unorganized meeting had no power to modify the report. The report was presented to it simply to encourage additional opinions, or similar opinions, possibly with the whole intent of submitting the results of the meeting to the board of directors, together with the report of the development committee which had been formally voted upon the day previous.

It is to my mind a little unfortunate that those at that Thursday night meeting should have gone away with the impression that this thing had been hastily put through, for in my opinion those gathered there were probably the most thoroughly representative of one class of the Institute that could be obtained under similar conditions; and furthermore, I am inclined to believe, from the lack of their understanding of the whole situation, that they were the least informed, apparently not having taken advantage of the opportunity that had been previously given to express opinions.

Notwithstanding these things, it is to be observed that the final conclusions at the meeting were substantially in accord with those of the final meeting of the development committee held the day before. There is a general impression that some change is desirable, and to my mind there was a rather marked unanimity of opinion crystallized in the form of the report, indicating along what general line changes in Institute activities should be made.

It is further to be observed that most people are aware of the value of the Institute and do not want to change its activities radically. On these grounds, therefore, I am quite confident that much good will come of this whole investigation and discussion which took place both through the mail and at the meeting at Lake Placid. To my mind there is no danger of the Institute making any serious mistake in modifying its plan of action, whereas, on the other hand, I feel quite confident that much benefit will accrue from some of the changes which have been suggested. WALTER A. HALL,

Chairman Sections Committee, A. I. E. E.

West Lynn, Mass.

# STATION & OPERATING PRACTICE

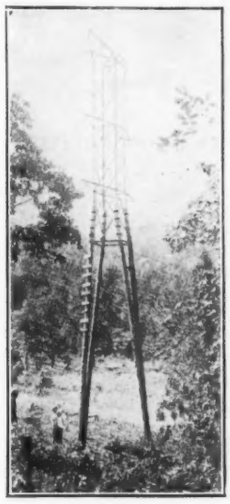
A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

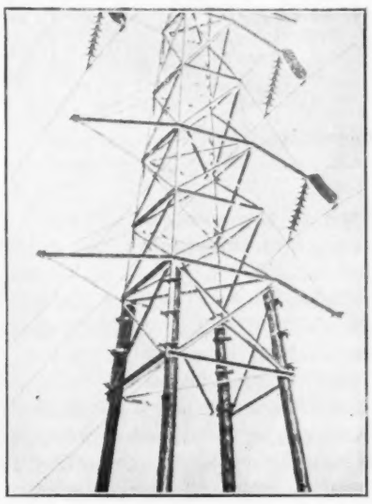
## COMBINED WOOD AND STEEL TRANSMISSION-LINE TOWER

### Saves 10 per Cent on Whole Line Over All-Steel Structure and Is Estimated to Last at Least Ten Years

During the war, when steel was high in price and difficult to obtain, large transmission-line construction had to be foregone excepting where it was absolutely needed. The lessons learned by central stations in effecting economy by interconnection, loading existing lines, etc., all should be remembered, because with prices remaining high every possible economy must be made.

One instance of a war-time method that can be applied now is where an economy of 10 per cent on a





FIGS. 1 AND 2—STRUCTURE FOR MAKING TORSION TESTS AND FOUR-POLE STRUCTURE WHICH IS PLACED AT INTERVALS NOT GREATER THAN 1 MILE

27-mile (43-km.) line was obtained by the Alabama Power Company, of which F. C. Weiss is superintendent of line construction, by a combination structure of wood and steel towers. Two types of towers were used, one with two and one with four legs, and while the majority of the line was of two-legged construction, there was used at the points of particular stress, and at least at intervals of not more than 1 mile (1.6 km.), the four-pole structure. The two-legged structure consists of two creosoted long-leaf yellow-pine poles supporting a galvanized-steel superstructure holding Ohio brass suspension insulators of approximately 1750 lb. (800 kg.). The four-legged structure consists of four such poles supporting a galvanized superstructure of about 2650 lb. (1250 kg.). The normal spacing at the foot is 15 ft. (4.5 m.), using 50-ft. (15-m.) poles with 8-in. (20-cm.) tops, while the steel superstructure is 32 ft. (9.7 m.) in height. The cost of excavating for this type was less, the cost of hauling more, and the erection or assembly was less. The service that can be expected from this structure is about ten years, but as the wood fails it can be easily replaced.

## PARAFFINE THOUGHT TO CAUSE JOINT FAILURES

### Failures Also Due to Joints Being Made by Inexperienced Men—School of Instruction and Substitution of Joint Compounds

After installing about 273 miles (439 km.) of 24,000-volt cables several years ago, the Detroit Edison Company thought that the joint problem had been satisfactorily solved. Shortly thereafter, however, there were quite a number of joint failures which were found to be due to carclessly made joints, and for this reason a school was started to instruct men in the proper method of making joints. Since that time some 1515 joints have been installed and only two have failed, but on an examination of the joints it has been found that large voids exist in their interiors between the three conductors. The use that had been made of paraffine for filling these joints was thought responsible for the voids, so the joint was refilled with a compound. Now, according to A. A. Meyer, the losses have been almost entirely eliminated.

## BLOWDOWN PIPE THERMOMETER CHECKS BOILER OPERATION

### Makes Record of Number and Duration of Blowdowns and Prevents Steam Lost from Being Charged Against Efficiency

By installing a recording thermometer in the blowdown pipe, a Middle West central station operating about 9000 hp. of boilers has been able to tell the exact efficiency of the boiler. The twenty-four-hour chart which the thermometer produces shows the number and duration of boiler blowdowns during that period of operation, which is direct evidence as to whether or not heat units are being wasted for this operation. Since the instrument is installed on the pipe leading from all boilers, it does not show which boiler is not being properly operated, but this can usually be discovered by the operating force.

Another important consideration that entered into the installation of the thermometer in this plant was the fact that the boiler-room employees operate on a bonus system which is based on water evaporated. Since the water is metered as it enters the boilers and since steam is not metered, the installation of the recording thermometer was thought wise in order to reduce any temptation there might be to increase evaporation rec-

ords by blowing down to an excessive degree during the night.

On the whole the instrument is now regarded as highly necessary in its present location for the close check it gives on proper operation.

## AN INDOOR SUBSTATION WITH GOOD ARRANGEMENT

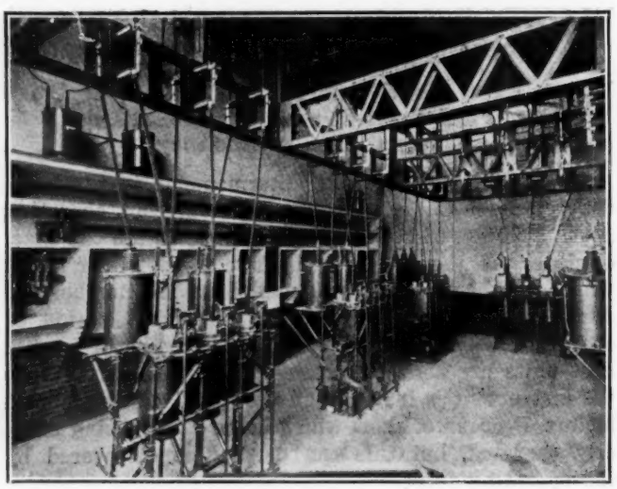
### Care Taken to Mount Apparatus Where It Will Be Afforded Adequate Protection Against Fire and Will Offer the Least Hazard

In modern indoor substation design, unlike outdoor style, care must be taken to secure an arrangement which is not only safe but so laid out that the equipment can be easily operated. There is usually only a limited space to place the apparatus and the best arrangement possible must be had. The installation shown illustrates how this problem may be handled for affording adequate protection against fire and to offer the least hazard to operators.

As the 22,000-volt disconnecting switches had to be mounted at a considerable height, the contact jaws were equipped with blade guides which insure that, when closing, the switch blade will correctly register with and enter the contact jaw.

Between the potential transformers and buses are installed disconnecting switches equipped with fuses which have a high rupturing capacity. In case of transformer failure the transformer will be instantly disconnected and eliminate the serious trouble incident to short circuits at the bus.

The 2200-volt high-ampere-capacity disconnecting switches are equipped with positive safety locks which eliminate the danger of switch blades being thrown open by heavy current surges. The buses are equipped with extra heavy busbar supports having an ultimate strength of 60,000 lb. (27,500 kg.) against the short-



SWITCH CONTACT JAWS EQUIPPED WITH BLADE GUIDES

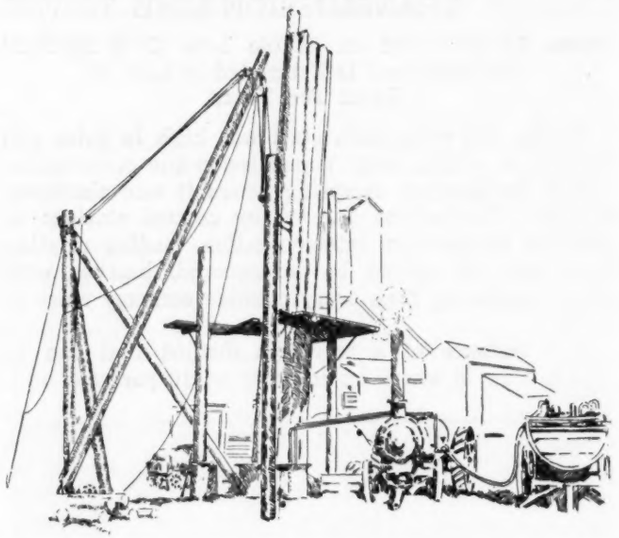
circuit forces betweeen phases. These supports are so designed that the parts are separated into two parallel sets, thus increasing the capacity over that possible with the ordinary type, having approximately ¼-in. (6-mm.) spacing between bars.

This installation was designed by the Delta-Star Electric Company.

## PORTABLE EQUIPMENT FOR TREATING POLES

### Fifty Poles Can Be Treated Each Day at a Rate of $1.17 Each by Use of Apparatus Which Permits Both Hot and Cold Treatment

Instead of having its line poles sent to a central point to be treated and then reshipped in small lots to places where they are needed, an Indiana transmission company has made a portable outfit which is taken from



DIPPING POLES IN TANK OF PRESERVATIVE COMPOUND HEATED BY STEAM COIL

town to town on motor trucks. This scheme, which allows the shipping of the poles direct to their final destination, has proved both economical and convenient as it is easier to transport the outfit to the towns, which are about 10 miles (16 km.) apart, than to redistribute the 35-ft. (10-m.) poles.

A crew of six men can treat about fifty poles a day with this outfit at an average cost of $1.17 per pole. The average absorption is 5 qt. (4.5 l.) per butt treated. It usually requires one and a half hours to treat a bunch of poles, the majority of this time being devoted to the hot "avenarius-carbolineum" treatment (200 deg. Fahr., or 93 deg. C.), whereas the cold treatment is only momentary.

The illustration herewith indicates the equipment employed, which consists of two tanks, a derrick, an inclosure for holding the poles upright in the tanks, automobile trucks and an old traction engine from which all the superstructure has been removed. The treating compound is heated by means of steam coils consisting of twenty bends of 1-in. (2.3-cm.) pipe 10 ft. (3 m.) long which is connected with the old traction engine boiler. The process of treating involves lifting the pole from the stock pile and standing it upright within the inclosure; from there the pole is transferred to the hot tank, then to the cold tank, and finally to the pole yard.

One man works on the rock pile, and another acts as teamster; there are two framers, one deck man and one tank man. Practically all of the equipment is handled by the boom derrick used in lifting poles. Therefore after the derrick has been set up it is an easy matter to place the deck poles in position and to construct the platform.

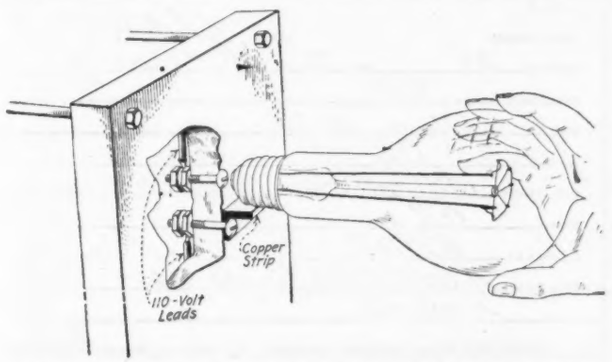
# INDUSTRIAL APPLICATIONS

## The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

### QUICK AND SIMPLE METHOD FOR THE TESTING OF LAMPS

**Can Be Made at Very Small Expense and Is Ideal for Use Where a Number of Lighting Units Must Be Tested**

In large industrial plants and office buildings the electrician is called upon continually to renew lamps, and some method must be had to find out whether new lamps are in good condition. Many methods are in use




MINIATURE, EDISON OR MOGUL BASE LAMPS CAN BE TESTED

for this purpose, one of the simplest being illustrated here. It consists of two brass screws which are placed in holes slightly more than ½ in. (1.3 cm.) apart on a wooden or slate board. To the lower screw a strip of copper bent at right angles to the face of the board is attached. Leads from the 110-volt lighting circuit are attached to ends of these screws projecting through the board. Then by placing the lamp on the copper strip and touching the upper screw with the lower end of the base an indication is obtained as to the condition of the lamp.

CHARLES E. SMITH.

New York, N. Y.

### EMERGENCY MOTOR REPAIR PROVIDES GOOD SERVICE

**Installing Fixture Wires in Place of Burnt-Out Stator Coils Allows Damaged Motor to Be Quickly Placed Back on Line**

When continuous operation means much to industrial plants, any expedient to prevent shut-down of a machine for some length of time is justifiable, even though later a break-down may occur.

Spare motors can often be used for replacing damaged machines, but it sometimes happens that the correct size is not available. In a plant in New Jersey where a number of different types of motors are used and consequently spares for all kinds cannot be kept in stock a two-phase, 3-hp., 220-volt induction motor was submerged in water for a few hours. This caused two coils in the stator winding to burn out owing to a grounded wire in one of the coils. The coils were carefully cut as near where they entered the stator slots as possible and pulled out from the other end of the slot, leaving a nicely formed space. Then No. 16 B. & S. gage rubber-covered fixture wire (same gage as wires removed) was threaded back and forth through the empty stator slots in the same position as the coils just removed until the slots were full. The newly made coils were connected properly and were taped and painted with insulating paint.

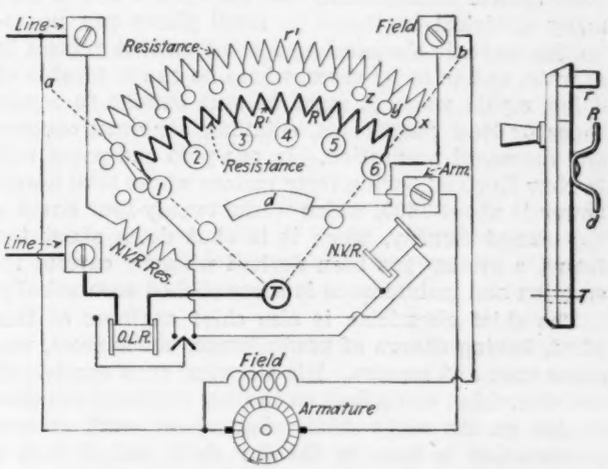
Although this motor is in service twenty-four hours every day, it has not been shut down, and it is working at full load most of the time, and this though the number of turns in the original coils was far in excess of the coils made from fixture wire.

Bound Brook, N. J. IRVING E. SWEAZEY.

### BROKEN RHEOSTAT CONTACT CAUSES MOTOR FUSE TO BLOW

**Entire Field and Armature Resistance Was Thrown in Circuit with Field of Motor at One Time, Which Increased the Speed of the Motor**

The field-control type of starter and regulator used with adjustable-speed motors appears to be not as well understood by caretakers as are the older and simpler plain starting boxes used with motors of constant speed. If trouble occurs with this type of regulator, a thorough understanding of the working principle must be had in order to locate the trouble. For instance, it might not be commonly known that contacts *dR* and *r*




CONNECTIONS OF FIELD-CONTROL MOTOR-STARTER AND REGULATOR

are electrically the same, being mounted on the two-part metal handle. On moving the handle to the right, the upper section carries the lower section with it; but on moving the handle to the left after having gone as far as possible to the right, the holding or no-voltage

release magnet holds the lower section in dotted position *Tb* and only the upper section moves to the left. The moving of the lower section to the right, cuts out the armature resistance included between the larger buttons and in the position *Tb* all of his resistance has been cut out. Contact *r* engages the smaller resistance buttons on all notches without effect until all armature resistance has been cut out, because until then the resistance field buttons are short-circuited. This is because contact *dR* engages segment *d* in all positions excepting final position *Tb*, where current from the handle cuts resistance into the field circuit, for when contact *r* rests on field button *z*, for example, current, in order to reach the field connecting post, must pass through all resistance included betwen the buttons *z* and *x*. And when the upper part of the handle is brought as far to the left as possible all of the field control resistance is included in the field circuit.

In one industrial plant the necessity of fixing the preceding facts well in mind was demonstrated when a 500-volt motor developed a tendency to blow fuses and to increase its speed on starting; this action suggested field resistance trouble. Inspection disclosed that the contact *r* was missing. This meant that in passing the handle from button No. 5 to button No. 6 all current that reached the motor field had to pass back through the armature resistance and through all of the field resistance, because after leaving No. 5 segment *d* no longer makes contact. On replacing the contact *r* operation became normal. E. C. PARHAM.

Brooklyn, N. Y.

## INSPECTION AND MAINTENANCE PREVENTS PLANT SHUT-DOWN

### Costs Only 50 Cents a Day per Motor to Maintain Equipment—Nearly Twice as Many Motors Could Be Handled by Crew

While in almost all large industrial plants there is some system of inspection that has been found to pay, many electrical engineers in small plants pay no attention to their electrical equipment until it refuses to operate, and in many cases, where no one is capable of doing repair work, it must be sent outside to repair shops or local electricians, entailing abnormal expense and decreased production. In one pulp and paper mill in New England having forty motors whose total horsepower is about 1500, which works twenty-four hours a day except Sunday, when it is shut down about ten hours, a system has been devised whereby careful inspection and maintenance is accomplished economically.

The chief electrician is also chief engineer of this plant, having charge of power house, boiler room, machine shop and repairs. His electrical crew consists of one electrician and helper on the day shift and one electrician on the night shift. Any repair work or new construction is done by the day shift, and if it is a large job help is borrowed from the steamfitter's crew. The helper on the day shift oils the motors and on his trips about the mill he records reading of the ammeters on each motor. If one machine is taking too much current, the trouble is found and fixed. He also reports frequently to the chief engineer's office to take any orders that may have been reported and to keep the chief informed as to the electrician's movements.

The night man inspects every motor six times during the night, recording the ammeter readings. He also renews lamps and does small necessary repair work, such as replacing lamp cords, renewing fuses and the like, and makes his headquarters at the mill store, where he gives out any material and tools that may be needed in the night.

On Sundays the motors are cleaned with compressed air at 80 lb. (3.5 kg. per sq.cm.) pressure, some motors being cleaned every week, while the more protected ones get cleaned only once a month. A card as shown herewith is filled out concerning every motor that is overhauled or cleaned, and these are filed and give reliable figures on the maintenance cost of different types of motors, besides forming a check on the work done.

Motors are wound and relay coils and the like are made in spare time by the day electrician. It is also the practice of this mill to take down the motors about twice a year and give the windings a coat of varnish. The windings of all new motors are given an extra coat

Form A-4

Motor Record Date July 6, 1919

Motor No. 21 H.P. 30 Location Recovery

Condition Bearings O.K.

Oil New 4 qts

Air Gap O.K.

Compensator Will need new segments soon

Relays O.K

Cleaned by Elliott No. Hrs. 2 R. 45¢ C. .90

New Parts 4 compensator Fingers @25¢ 1.00

4 qts oil .50

Maintenance Cost 2.40

BY MEANS OF THESE CARDS AN ACCURATE ACCOUNT OF MAINTENANCE EXPENSES IS OBTAINED

of varnish because the chemicals in the plant attack the insulation.

The cost of inspection and maintenance of labor is about 50 cents per twenty-four hours for each motor, and this rate could be further reduced because the same force could handle at least twenty additional motors except on Sunday, when helpers could be obtained. In addition, the salary of a storekeeper during the night is saved. W. B. SMITH.

Aroostook Pulp and Paper Mill, Van Buren, Me.

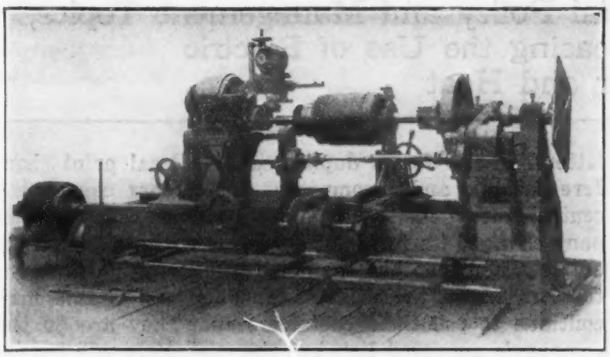
## MACHINE FOR DOING ARMATURE REPAIR WORK

### One Machine Equipped with Three Motors Can Be Used for Almost Any Operation in Shop from Winding Coils to Banding

Armature repair shops are usually filled with numerous home-made devices more or less efficient and taking up considerable space, but, nevertheless, they have the advantage of allowing a larger number of armatures to be repaired at the same time. If only enough work is required to keep one repairman busy, however, a machine capable of performing all of the operations may be desirable.

Such a machine which will perform all sorts of armature repair work is used in the repair shop of the Washington (D. C.) Railway & Electric Company. The machine, which was obtained from the Electric Service Supplies Company, will handle armatures from 5 hp. to 300 hp. or 400 hp. and is capable of being a banding

machine with self-contained tension carriage, a commutator slotting device with independent motor, a commutator grinding device with independent and auto-



MACHINE FOR ALL KINDS OF ARMATURE REPAIR WORK

matic feed in both directions, a commutator cutting or truing attachment with automatic feed in both directions, and has a field and armature coil plate suitable for all classes of heavy form-coil winding.

After the coils have been placed in the slots and the leads have been soldered to the commutator, an armature can be placed in the machine and all remaining operations performed to complete the armature without removing it from the machine.

When the banding device is stopped it locks automatically to prevent any backward motion of the armature which would cause slack in the band wire. Uniform tension on the band wire is secured by a tension machine mounted on the feed carriage and traveling with it. After the banding operation is completed, the band wire is clamped by a device fitted to the feed pulley and is ready for the next armature without disturbing the tension. An index dial is provided on the tension machine so the same tension may always be used.

The slotting attachment is provided with a universal form of bracket by which it can be clamped to the tailstock spindle, or direct to the armature shaft when working on armatures with extra long shafts. The slotting tool can be adjusted for cutting the slots when they do not run parallel to the shaft. The entire slotting attachment can be removed or replaced by loosening two cap screws.

The commutator grinding and turning devices are incorporated into a single unit and mounted on an independent cross slide which may be brought close to the commutator so as to give a solid support to the tools. Both the grinding and turning tool are provided with automatic power feeds.

The power feed for the commutator grinding and cutting devices is transmitted to a small countershaft, mounted on the head stock with a cone pulley allowing three speeds for feeding, from whence the power is transmitted to the commutator grinding and cutting devices by means of a telescoping shaft with two universal joints. Three lengths of shaft are provided to allow for various lengths of armature, the changes being made by the removal of one bolt.

Means are also provided for hand control of both attachments when desired. The device, therefore, cuts and trues the commutator and the cross slide is adjustable in all directions and carries a tool post block with standard tool. The device will handle commutators up to 24 in. (60 cm.) in diameter and 16 in. (40 cm.) long.

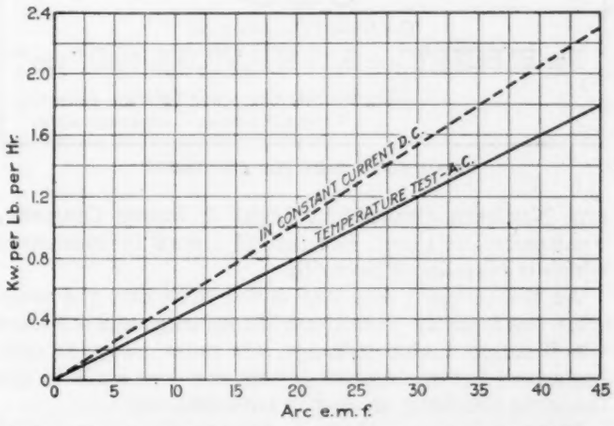
A coil-winding plate is mounted on the spindle and thus has the same speed changes and control as the main machine, the foot treadle being extended in line with the plate. It is suitable for all kinds of medium and heavy form-coil work.

The machine is equipped with three Robbins & Myers motors, a main motor of 2-hp. capacity, the commutator grinder attachment motor of ½-hp. capacity, and the commutator slotting attachment motor of ⅛-hp. capacity. The outfit can also be supplied for belt drive from a line shaft where this is desired.

## COATED ELECTRODE FOR ALTERNATING-CURRENT WELD

### On Account of the Insulating Quality of Coating, It Takes Comparatively Small Amount of Energy to Produce Operating Temperatures

Because they retain hot vapors more readily, coated electrodes assist greatly in holding the arc on alternating-current welding systems. The characteristics shown in the accompanying curve cannot be compared directly with direct-current arcs because the melting rate of the alternating-current arc with coated electrode is much higher than the direct-current arc with bare electrode.




DIRECT COMPARISON CANNOT BE MADE BECAUSE MELTING RATE OF COATED ELECTRODE IS HIGHER

The temperature is proportional to the kilowatts per pound of electrode melted per hour and is expressed in this unit. The curve is obtained by dividing the power dissipated in the arc by the rate at which the metal is melted at the current value in question.

The energy released on the electrode side of the arc is greater, and on account of the insulating quality of the coating it takes less energy to produce the operating temperature.

## Anchor Chains Electrically Heat-Treated

In heat-treating anchor chain at the Cleveland plant of the National Malleable Castings Company, where 600-kw. hardening furnaces and 300-kw. temper-drawing furnaces are employed with a capacity of 50 tons of chain a day, the energy consumption at capacity is 450 kw.-hr. per ton. This is 150 kw.-hr. higher than that in the Sharon plant, where the furnace chamber is smaller. The chain remains in the hardening furnace two hours, when it is entirely heated to the furnace temperature of 1650 deg. Fahr. (900 deg. C.), and an equal period in the drawing furnace. The information was prepared from data compiled by T. F. Baily, president of the Electric Furnace Company.

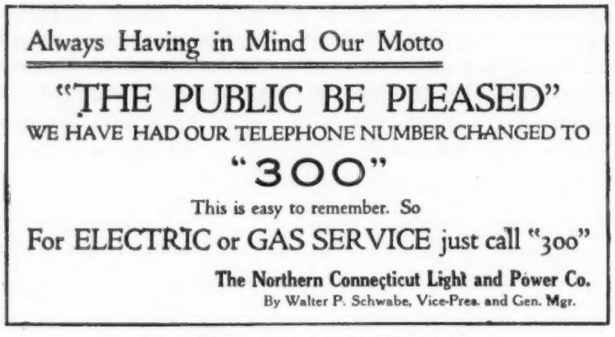
# CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Methods for Increasing the Use of Electric Light, Power and Heat

## TELEPHONE NUMBERS THAT ARE EASY TO REMEMBER

### Getting "Main 300" Instead of "Main 3974" and Letting the Public Know that This Is Done to Facilitate Communication

Believing that a public utility manager should have constantly in mind the obligation to render service to the consumer even to the extent of selecting a telephone number that is easy to remember, Walter P. Schwabe, General Northern Connecticut Light & Power Company, Thompsonville, Conn., has mailed a card to consumers which is reproduced herewith.


Always Having in Mind Our Motto
"THE PUBLIC BE PLEASED"
WE HAVE HAD OUR TELEPHONE NUMBER CHANGED TO
"300"
This is easy to remember. So
For ELECTRIC or GAS SERVICE just call "300"
The Northern Connecticut Light and Power Co.
By Walter P. Schwabe, Vice-Pres. and Gen. Mgr.

MAKING IT EASY FOR CUSTOMERS

As the company has two direct lines into the main office, one from the Thompsonville exchange and one from the Windsor Locks exchange, six miles away, it took some time before an arrangement could be made to get the same telephone number in both exchanges.

Many department stores and many other commercial houses dealing in a large way directly with the public arrange to have telephone numbers that can be remembered easily.

## UTILITY USES COPYRIGHT TO PROTECT CUSTOMERS

### Cleveland Company's Plan to Prevent Its Forms Being Copied and Used by Unauthorized Persons Misrepresenting the Company

Central-station campaigns to encourage contractors to wire old houses usually develop, by a process of elimination, a list of approved contractors whom the utility has found by experience do good work. Contractors who are not on the list are anxious to get the house-wiring business, though they will not get any bonus that the utility may give. One of the many plans adopted by the unapproved contractors is to get contract forms from the central station to try to prove to prospective customers that they represent the utility.

The Cleveland Electric Illuminating Company was confronted with this practice, and when it stopped the supply of forms to the unauthorized contractors the latter had the forms duplicated in a local print shop. Irresponsible and incompetent contractors caused the central-station customers so much trouble that the company changed its forms of old house-wiring agreements entirely, and then had the new forms copyrighted. Contractors whom the utilities consider undesirable may continue to tell their customers that they are on the company's approved list, but the customers will not be so ready to believe contractors who are not supplied with the copyrighted contract forms supplied by the public service company.

## ELECTRIC STREET LIGHTING MAY SUPERSEDE GAS LIGHTING

### Kansas City Company Is Now Installing Electric Units at Street Corners and May Replace Other Gas Street Lamps

In Kansas City, Mo., one of the few large centers where gas street lighting still predominates, a start has been made toward the replacement of gas by electricity. About 1000 electric lighting standards are now being installed at street intersections, and it is expected that this installation presages a larger one to follow.

## HIGHER MINIMUM CHARGES NECESSARY FOR FARMERS

### As Education of Both the Small Central-Station Man and the Farmer Progresses Minimum Increases from 50 Cents to $8 Per Month

When farm lighting from central stations was first talked of it seemed difficult to secure higher rates in the country than in the city. So the initial experiments in handling this class of business were hampered by the low minimum charges then in existence in many of the smaller cities. Instances wherein farmers were taken on at a 50-cent minimum bill with rates identical with those in town can be recalled easily.

More recently, however, the fallacy of that practice has been appreciated. Now when farm lines are built they are still considered somewhat experimental in nature and it is felt that the minimum charge should be at least high enough to guarantee the charges that must be made against the line as an extension. The central-station man has educated himself up to this point. The farmer has come to realize the reasonableness of the high minimum bill partly because he now knows how much it would cost him by comparison to operate his own farm-light plant to secure comparable service.

The State of Iowa is leading in this movement for higher minimums just as it leads in many things pertaining to agriculture. Minimum charges for farm service are not uniformly up to a fair standard there yet, but the tendency is to get them up. Many com-

panies are asking $4 a month, some are asking $5 a month and a few are asking $8 a month. None of these charges are considered excessive. In fact, it is the opinion that only when the minimum charge is above $5 has the company an opportunity to make a fair profit on the farm business.

As an example of the way some of the smaller companies are handling this business a farm-lighting contract used by the Armstrong Cement Works is reproduced here. This company charges a $4 minimum for all farmers connected to its 2300-volt and 6600-volt lines. It also charges $300 for a connection to its lines based on five connections in every two miles, making the connection cost $750 a mile. This is not as high as a similar charge made by some other companies. It will be noticed that the minimum charges are based on transformer ratings necessary to operate certain sizes of motors. This is done because the company is endeavoring to place a motor for pumping and other light power jobs on each farm. The contract reads:

FARM LIGHTING CONTRACT

Armstrong, Iowa, ..... 1919.

Whereas the Armstrong Cement Works of Armstrong, Iowa, hereinafter referred to as the party of the first part, proposes to construct a transmission line for the transmission of electricity for light, heat and power, from Armstrong, Iowa, to.....along the.....road, and purposes to furnish connections with said line to the various residences, farms and business places along said line, for the sum of three hundred dollars, the payment of which shall give to the residence, farm or business owner along said line the right to connect his residence, farm or business place with said transmission line and receive electricity for light, heat or power as long as said line is in existence, whether maintained by the Armstrong Cement Works or its successors or assigns, for the rates hereinafter set out or as shall be otherwise mutually agreed upon by the parties hereto.

In consideration of the construction and maintenance of said transmission line in accordance with the terms of this contract, and of the completion thereof on or before....., the undersigned, hereinafter referred to as the party of the second part, agrees to pay for the right to connect his residence, farm or business place, hereinafter described, with said transmission line and receive electricity therefrom for light, heat or power, the sum of three hundred dollars, but if said line shall not be completed by.....then this contract to be void and not binding upon either party.

Upon completion of the transmission line as hereinbefore described said party of the first part agrees to furnish a transformer on said line, at a point in the public highway on said transmission line nearest the residence, farm or business place of the party of the second part, for the purpose of furnishing electricity, and agrees to furnish electricity to and through said transformer to party of the second part, single-phase, at 110 and 220 volts, for light, heat and power at the same rates and charges as those paid to party of the first part by users and consumers in the town of Armstrong, Iowa, for the same services except that the minimum rates charged for electricity shall be $4 per month, where a 3-kw. transformer is used, which will allow the use of sufficient lighting for the ordinary farm together with the electric iron and power up to 0.5 hp. at the same time, or a 3-hp. motor when used alone, or $6 per month where a transformer is furnished by party of the first part sufficiently large to carry a 5-hp. motor, but with said exception the rates for light, heat and power shall be the same as those charged by party of the first part to its patrons in the town of Armstrong, Iowa.

It is agreed and understood that the party of the second part shall build and maintain his own line from the transformer on the transmission line of the party of the first part, as above described, to his residence or farm or business place, and wire his own residence, farm or business place at his own expense; it being understood that this agreement does not require the party of the first part to construct or build any lines or to do any work beyond the transformer on its own line.

The residence, farm or business place of party of the second part to be connected with the aforesaid transmission line as above agreed upon is on.....

## HARTFORD'S REAL ESTATE RENTAL SERVICE POPULAR

### In This Time of Scarcity of Living Quarters Help Is Given to Many People Who Become Better Acquainted with the Company

About forty inquiries a day are received at the office of the Hartford (Conn.) Electric Light Company in connection with the apartment and house rental service information which the company has been giving free of charge for several months.

A bulletin board and map have been hung in the contract department for consultation by visitors. The bulletin board carries eleven lines of rental cards for the single suburban and ten city ward districts of Hartford, showing the essential facts regarding each rental. At the front of the board a shelf is provided, with pads and pencils for use of inquirers. The pads are assembled from obsolete bills. At the right is a map of the city showing the different wards in colors and by number.

NOTICE

1. There is no charge for this service.
2. Do not hesitate to ask us questions.
3. The information on these cards is exactly as represented to us. If wrong, you will confer a great favor by reporting it to us.
4. Cards are removed as soon the premises are reported rented.
5. New cards are added each day; therefore, if you are not successful in locating a rent which is satisfactory to you, please call again.

THE HARTFORD ELECTRIC LIGHT COMPANY.

A POPULAR REAL ESTATE ADJUNCT TO CENTRAL-STATION SERVICE

Houses and apartments wired for electric service are in great demand at this time in Hartford, and the company has made many friends by this service, which now requires the attention of one employee for a considerable share of her time. A small press notice is carried in the local dailies by the company calling attention to the information available at the office. When visitors call they pass through the appliance department before reaching the real estate bulletin.

## Industrial Promotion Work

The Boston Edison company endeavors to bring manufacturing plants into its territory by promotion work somewhat similar to that of local chambers of commerce. Recently the company prepared an extended communication on the ice market at Boston for an ice-making concern in the Middle West which contemplated moving to New England. The data included an analysis of the water at Boston. It was determined that about 2 tons of ice per capita per year are used in the Boston district for an estimated population of more than 1,000,000.

# DIGEST OF ELECTRICAL LITERATURE

## Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

### Motors, Generators and Transformers

*The Insulation of Distribution Transformers.*—A. C. FARMER.—The particular problems in the design and construction of distribution transformers taken up by the author are the effective insulation between primary and secondary made up of a micarta barrier, the impregnation of the coil, the insulation of high-tension coils in particular, and the construction of entrance workings.—*Electric Journal,* May, 1919.

*Predetermination of Current-Transformer Characteristics.*—E. WIRZ.—The author shows in detail how the characteristics of current transformers may be predetermined by the designer and made to come within the limits specified by a law of Jan. 1, 1917. By this means the cost of adjusting transformers may be reduced materially. The special requirements to be satisfied are: (1) The load capacity of the secondary circuit must be greater than 10 volt-amp.; (2) the transformer ratio must not differ by more than 1 per cent from the nominal value, at normal frequency and for currents from 10 per cent to 100 per cent of rated value; (3) the phase displacement between primary and secondary current may not exceed 1 deg. The author's theoretical investigation is based on experimental results and on the fact that there is a definite maximum secondary output for current transformers. The output rises from zero on open circuit to a maximum and returns to zero on short circuit. The author investigates the variation of secondary output with secondary current (the primary current being constant) and shows analytically and vectorially how all the factors concerned may be determined so as to keep the characteristics within statutory limits.—*Science Abstracts, Section B,* April 30, 1919. (Abstracted from *Schweiz. Elektrot. Verein, Bulletin* 10, January 1919.)

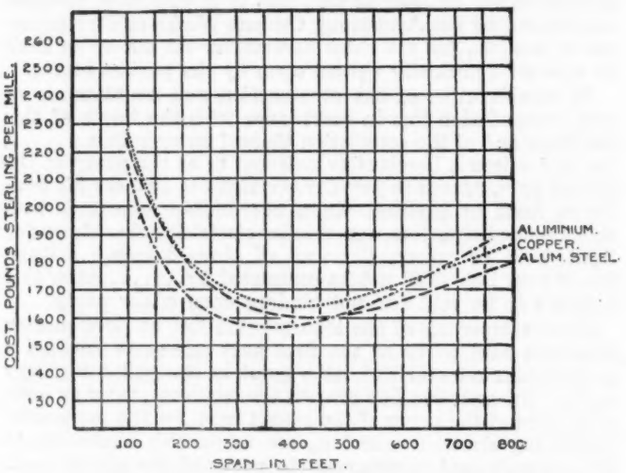
### Generation, Transmission and Distribution

*Spinning Mill's Hydroelectric Scheme.*—An account of how the energy of a small waterfall was utilized for driving a woolen spinning mill. Several natural springs controlled by the firm exist and the fullest advantage has been taken of the energy available. A reservoir has been provided having a capacity of 6,000,000 gal. (22,700,000 l.) and fed by springs rising some 1500 ft. (450 m.) above sea level. By means of this reservoir a fall of 500 ft. (150 m.) is obtained, the water being conveyed through 9-in. (22.9-cm.) cast-iron pipes to the power house, which lies three-quarters of a mile (1.2 km.) below. The conditions imposed upon the contractors laying down the installation were that the turbine plant be entirely automatic and self-governing, that it be started and stopped from a mill half a mile (800 m.) away, that the speed be kept constant under all conditions to insure the very steady drive required by the mill, and that it be unnecessary for an attendant to pay more than one visit per day to the power house. The power house contains a tangential wheel of the Pelton type running at 600 r.p.m. and coupled to a 68-kw. continuous-current dynamo. The generator is compounded so that the mill voltage is maintained constant at all loads.—*Electrical Industries,* London, May 21, 1919.

*Final Inspection of Boiler Plants.*—D. G. WALLACE.—The author presents a method of determining the presence of air leaks in a boiler furnace different from that usually employed. It is used in the final inspection of the boiler after repairing or other work has been completed and before the boiler furnace is fired up.—*Power,* July 8, 1919.

*Turbine for Mechanical Drives.*—R. R. LEWIS.—This article deals with the development and construction of small and medium-sized turbines for the direct drive of pumps, etc. A description is given of the facility with which a selection can be made of standard parts to produce the turbines best adapted to the conditions of the particular application.—*General Electric Review,* June 1919.

*Aluminum Conductors for Overhead-Power Transmission Lines.*—ARTHUR JACOB.—The author first summarizes a few general conditions relating to high-voltage transmission lines and then applies these to the use of aluminum conductors. The conductivity of aluminum and copper, their relative densities, tensile strengths and other qualities are discussed, and an account is given of the sag problem and the considerations affecting the choice of wooden poles or steel towers, which have special advantages where large spans are used. The relative costs of copper, aluminum and aluminum-steel conductors are calculated, and finally a brief account of some typical transmission systems using aluminum cables is given.—London *Electrician,* June 27, 1919.




CURVES SHOWING APPROXIMATE COSTS PER MILE

*Effects of Ice on Overhead Wires.*—W. WITTEK.—The author proposes certain alterations in the formulas laid

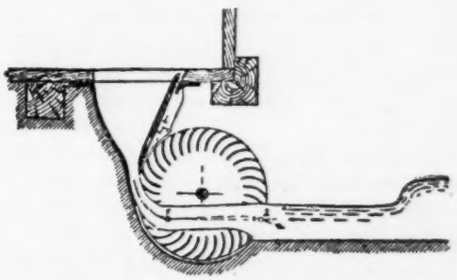
down in the official regulations with regard to the maximum load due to the weight of suspended ice attached to the surface of the overhead wire. Both copper and aluminum wires are taken into account.—*Science Abstracts, Section B,* April 30, 1919. (Abstracts from *Elektrot. Zeits.,* Nov. 28, 1918.)

*Reactance Values for Rectangular Conductors.*—H. B. DWIGHT.—Rectangular or strap conductors are commonly used in busbars to carry heavy alternating current in the supply circuits of electric furnaces and elsewhere. The reactance drop in such circuits is most conveniently determined from a set of curves, since the formulas which would be required for calculating results are rather long and complicated. The author offers such a set of curves and an explanation of their use.—*Electric Journal,* June, 1919.

*Economical Lubrication of Steam Engines, Etc.*—K. SCHMID.—The data presented in this article are derived from material collected by inspecting a great number of working installations. Only in five engines among those investigated was there a really low consumption of lubricating oil. The minimum was 0.178 gm. cylinder oil and 0.153 gm. bearing oil per horsepower-hour, and the mean was 0.24 gm. of cylinder oil and 0.23 gm. of bearing oil. In order to obtain results applicable to any engine, the oil consumption must be referred to the actual engine dimensions rather than to the horsepower developed. The author considers the important elements affecting oil consumption and makes many recommendations for improved economy. He considers that 90 per cent saving in cylinder oil is possible. A saving of 87 per cent in bearing oil has already been effected.—*Science Abstracts, Section B,* April 30, 1919. (Abstracted from *Geschaftsbericht,* Württemberg, 1915.)

*The Practicability of Transmission Lines at Highest Voltages in This Country.*—G. V. TWISS.—The author states that it would be deplorable, now that the opportunity to centralize generation of energy is at hand, if it were not possible to attain the highest economy in transmission. It would seem, however, that there is no valid reason, either climatic or in respect to safety or continuity of supply, why overhead transmission lines should not be used in the British Isles up to as high voltages as economy justifies, whether 100 kv. or more. The only impediment in this development is the existence of local and national restrictions, which should be removed. The writer states that the use of overhead cables rather than underground cables will give good service at less cost and will have important additional advantages in respect to the supply of agricultural and village requirements. He also states that the British manufacturers are handicapped by the lack of use of high-tension apparatus in Great Britain, saying, for instance, that America with its many miles of high-tension transmission lines inspires more confidence in possible purchasers than England, where such apparatus is not in use.—London *Electrician,* June 27, 1919.

*New Water Turbine.*—D. Banki of Budapest has devised a new water turbine to bridge the gap between the higher speed of the Pelton wheel and the lower specific speed of the Francis turbine. The new turbine can be installed as simply as a waterwheel and can be substituted for a waterwheel almost without structural alterations. It can be given the speed of the driven machine so as to eliminate gear transmission. Other advantages compared with waterwheel operations are low first cost, saving in space, higher efficiency, reduced operating and repair costs. Referring to the figure, the wheel consists of two disks carrying a series of cylindrical blades. The inlet is adjusted by hand, and the water imparts energy to the wheel both at entry and when it passes through the blades a second time at exit. The diameter of the wheel is independent of the quantity of water; the breadth of the wheel is chosen to suit the latter. Water is led to the wheel at an angle of 16 deg. The outer blade angle is 30 deg. and the inner



WATERWHEEL TO FILL THE GAP BETWEEN PELTON AND FRANCIS WHEELS

blade angle 90 deg., so that in both places the water enters the wheel without shock. The author compares the new turbine with other types under various conditions and gives examples ranging from simple waterwheels up to the largest modern installations. Tests with model wheels of the new type indicated efficiencies of 89 per cent and 87 per cent. The reason for the high efficiency of the wheel is to be found in the simple, almost loss-free passage of water through the blades. The kinetic energy of the outflowing water can be utilized to maintain an artificially lowered level at the turbine. The wheel may run partially submerged without appreciable loss of efficiency. Where the downstream level is very variable the turbine is built in an airtight casing and the water is taken away through a suction pipe. The new turbine is recommended specially for driving high-speed dynamos.—*Science Abstracts, Section B,* April 30, 1919. (Abstracted from *Zeits. Ges. Turbinenwesen,* Nos. 21-25, 1918; *Elektrot. Maschinenbau,* Dec. 29, 1918.)

## Installations, Systems and Appliances

*Selection of the Power Plant for the Mill.*—GEORGE J. YOUNG.—The efficient selection of the power plant demands a careful comparison of first cost of plant as well as of operating costs. Many appliances of excellent design and proved operating efficiency from which to select are available. A knowledge of what the machinery market offers and a thorough acquaintance with the operating conditions are necessary for a wise selection of the type of plant and the individual units of which it is to be composed.—*Engineering and Mining Journal,* June 28, 1919.

*Synchronous Motors in the Meat-Packing Industry.*—T. J. BYRNES.—It is stated that on account of the use of many induction motors about the plant of the Cudahy Packing Company at Omaha the power factor was low. This was corrected by the use of a synchronous motor drilling a deep-well pump and also by the substitution of synchronous motors for slip-ring induction motors which had hitherto been employed for driving refrigerating compressors. It is said that the synchronous motors of the speed and rating of those used to drive the refrigerating machines are cheaper than slip-ring induction

motors of the same size.—*General Electric Review*, June, 1919.

*Working Adjustments of Wethcrill Magnetic Separator.*—GEORGE J. YOUNG.—The details of construction of the magnetic separator are outlined with appropriate illustrations. The writer also discusses operating problems that determine the success of the installation.—*Engineering and Mining Journal*, June 28, 1919.

*Phase Transformation with Auto-Transformers.*—E. G. REED.—The writer discusses this problem in three parts—(1) when the two-phase voltage is greater than 86.6 per cent of the three-phase voltage; (2) when the two-phase voltage is less than 86.6 per cent of the three-phase voltage, and (3) when the two-phase voltage is greater than the three-phase voltage.—*Electric Journal*, May, 1919.

*Mercury-Arc Tube Operation.*—R. W. KIDD.—The writer deals with the mercury tubes used for series street-lighting purposes. He takes up certain operating difficulties such as "pumping," "dropping out" and "spot jumping," also failure of the tubes due to puncture and loss of vacuum.—*Journal of Electricity*, June 1, 1919.

## Electrophysics and Magnetism

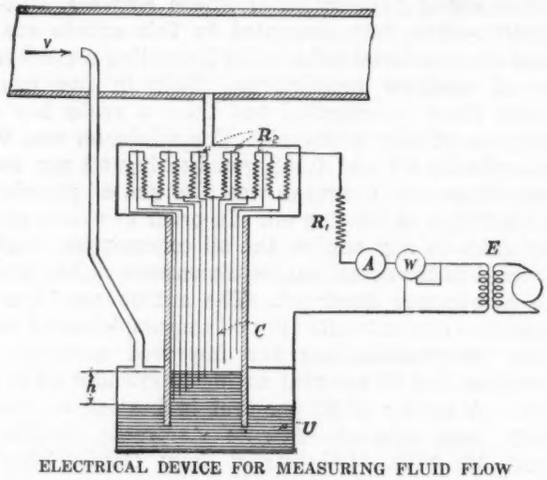
*Distribution of Electric Force in the Crookes Dark Space.*—USABURO YOSHIDA.—The distribution of the electric force in the Crookes dark space in a hydrogen vacuum tube was determined and a parabolic equation was found to hold true so far as the present experiment is concerned.—*Memoirs of the College of Science, Kyoto Imperial University, Vol. III*, August, 1918.

*Equation of the Magnetization Curve.*—M. DÉRI.—The author shows that the essential part of the magnetization curve may be represented logarithmically and a formula derived which is especially suitable for calculations. For any type of iron the fundamental equation is $B = K_1 (\log_e K_2 NC)$. $K_1$ and $K_2$ are constants and $NC$ the ampere-turns. Comparison is made with the magnetization curves for (a) armature stampings, (b) cast steel and (c) cast-iron given in Arnold's textbook "Die Gleichstrommaschine." The empirical formulas used are: (a) $B = 8300 \sqrt{(\log_e NC)}$; (b) $B = 8900 \sqrt{(\log_e NC/2)}$; (c) $B = 6000 \sqrt{(\log_e NC/10)}$, and over the range 6 to 200 amp.-turns the calculated values do not differ in any case by more than 2 per cent from the experimental.—*Science Abstracts, Section B*, April 30, 1919. (Abstracted from *Elektrot. u. Maschinenbau*, Feb. 25, 1917.)

## Units, Measurements and Instruments

*Measurement of Steam and Water in Power Stations.*—W. M. SELVEY.—The measurement of steam and water in power stations has recently assumed great importance. Many meters have been devised for this purpose, and they generally depend upon an application of Bernoulli's theorem. After briefly analyzing this basin, the author describes various types of meters which may be classified under the headings, (1) direct weighing, (2) automatic weighing, (3) automatic volume measurements, (4) flow meters, and (5) motor meters. The article is copiously illustrated with photographs and diagrams of apparatus discussed.—London *Electrician*, June 27, 1919.

*Electric Measurement of Fluid Flow in Pipes.*—JACOB M. SPITZGLASS.—The writer describes an electrical device making use of an ammeter and watt-hour meter to measure the flow and integrated quantity of a fluid which is briefly described as follows: Measurement is accomplished by means of an electric current, which is so regulated by the differential pressure of the flow that it represents the amount of fluid passing through the pipes. The main features of the device are shown diagrammatically in the figure. The U-tube, partly filled with mercury, is made to balance the impact pressure of the flow in the pipe by the rise of mercury in the low-pressure side of the tube. The mercury column also forms a part of the electric circuit, as shown in the figure. This electric circuit contains a fixed external resistance $R$, in series with a variable internal resistance $R$, a constant electromotive force $E$, an ammeter $A$ and a watt-hour meter $W$. In the contact chamber $C$, which forms the low-pressure side of the U-tube, there are a number of conductors of varying length




ELECTRICAL DEVICE FOR MEASURING FLUID FLOW

placed above the mercury column, and as the mercury rises it makes contact with one conductor after another. The variable resistance $R$ is subdivided by these conductors into varying resistance steps corresponding to the varying length of the conductors, so that the rise and fall of the mercury column varies the amount of resistance and thereby regulates the amount of current passing through the circuit.—*Journal of Society of American Engineers*, May, 1919.

## Telegraphy, Telephony and Signaling

*Hysteresis and Eddy-Current Losses in Iron at Radio Frequencies.*—C. NUSBAUM.—This paper describes a calorimeter method for the determination of the hysteresis and eddy-current losses in a certain specimen of soft iron at frequencies from 150,000 to 1,000,000 per second. Two similar toroids, one only containing the specimen of iron, are included in the same oscillatory circuit, and each is inclosed in a special calorimeter, care being taken to avoid radiation loss as much as possible and also inequalities of temperature. The losses in the iron are shown by the extra heat developed and this is balanced by a direct-current heating current through the other toroid. The results show that the heat developed per cycle by magnetic hysteresis and eddy currents in iron decreases with an increase in the frequency of the oscillating magnetic field. This fact indicates a decrease of the magnetic induction on account of the "shielding" effect produced by the eddy currents.—*Science Abstracts, Section B*, Aprli 30, 1919. (Abstracted from *Inst. Radio Eng. Proceedings*, February, 1919.)

# NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

## INTERNATIONAL ACTIVITIES OF ELECTROTECHNICAL BODY

### After Period of Quiescence Due to War, the International Electrotechnical Commission Will Meet in London in October

After a lapse lasting more than four years, owing to the war, the International Electrotechnical Commission has taken prompt steps to renew its operations. In May last a meeting of the committee on rating took place in Paris, with representatives from America, Belgium, France, Great Britain, Italy, Sweden and Switzerland. At this meeting certain electrotechnical misunderstandings were removed which had crept in owing to the impossibility of holding international meetings during the war. It is understood that the meeting was very satisfactory from all points of view.

It is now announced that a plenary session of the I. E. C. is being arranged for, in London, next October, so as to resume the work of the commission as early as possible. It will be necessary to revise the statutes, in order to reorganize and reconstruct the commission, now that the war is over.

## GOVERNMENT CONTROL OF WIRE SYSTEMS IS ENDED

### Supervision of Telegraph and Telephone Lines Relinquished by Postmaster-General on Aug. 1, and Companies Are Again in Control

Postmaster-General Burleson on Wednesday issued an order calling for the return at midnight July 31 to their respective owners of telegraph and telephone systems which have been under government control.

The text of the order for the return of the wires follows:

In accordance with the act of Congress approved July 11, 1919, and by direction of the President, all of the telegraph and telephone systems, lines and properties, including all equipment thereof and appurtenances thereto whatsoever, and all materials and supplies taken possession of or received, operated, supervised or controlled by the Postmaster-General under and by virtue of the joint resolution of Congress approved July 16, 1918, and the proclamation of the President, July 22, 1918, are hereby ordered to be returned and delivered to the respective owners thereof at midnight on July 31, 1919, and the supervision, possession, control and operation exercised by the Postmaster-General under and by virtue of said joint resolution and proclamation of the President will cease and terminate at that date and hour.

All such telegraph and telephone companies are hereby directed to close their books as of midnight July 31, 1919, and to proceed promptly to collect all outstanding indebtedness and accounts arising out of the operation of such systems during the period of government control, and at the earliest practicable time to submit a full account to William H. Lamar, chairman of the finance committee, Wire Control Board.

Each company with which a compensation agreement has been entered into, or to which compensation has been awarded, will, if its accounts show an excess over and above the compensation allowed, transmit such excess, together with a statement of account, within five days after the ascertainment of the amount due, to said William H. Lamar, chairman of the finance committee, Wire Control Board, in the form of a certified check or bank draft, payable to A. S. Burleson, Postmaster-General.

All books and accounts kept during the period of government control shall be preserved by the respective companies and shall continue under the control and supervision of said William H. Lamar, chairman of the finance committee, Wire Control Board, and shall at all times be subject to examination by the auditors and accountants of the Wire Control Board.

All companies under control of the government with which compensation has not been fixed or concluded by agreement or by operation of orders Nos. 2980 and 3175 should at once take up with said William H. Lamar, chairman of the finance committee, Wire Control Board, the matter of the fixing of such compensation, so that the Postmaster-General may make his report to Congress upon the operation of the various wire systems on or before Nov. 1, 1919, as required by law.

## NEW PUBLIC UTILITIES BODY FOR MASSACHUSETTS

### Commission Takes Over Power That Has Been Exercised by Two Former Commissions and Cost Is to Be Defrayed from General Taxes

In the closing hours of the Massachusetts Legislature of 1919 an act was passed which reorganized the machinery for regulating public utilities and abolished the Gas and Electric Light Commission and the Public Service Commission.

A new Department of Public Utilities has been created, with a commission of five members, to be appointed by the Governor with the consent of the Council for initial terms of one to five years and a later standard term of five years. The yearly salary of the chairman is to be $8,000 maximum and those of the other commissioners are not to exceed $7,000 each.

All the powers and responsibilities of the two commissions now merged are carried into the new tribunal. Appeal from and enforcement of its decisions lie in the Supreme Court of the state. To facilitate its work, two commissioners may hear cases and on agreement of all parties one member may sit. Routine and administrative matters may be heard by one member.

It is expected that the reorganization will effect economies in administration and in rent. The salaries of the commissioners are to be paid from the tax levy and utility companies will no longer be directly assessed for these, as was formerly the case in the regulation of gas and electric companies. The consolidation of about 100 state departments into twenty has been effected by the act.

# FREDERICK SARGENT, EMINENT CONSULTING ENGINEER, DIES

## Many of the World's Most Famous Steam Central Stations Stand as Monuments to His Genius as a Designer

Frederick Sargent, senior member of the firm of Sargent & Lundy of Chicago, and probably the most prominent consulting engineer in the United States specializing in the design of electric generating stations, died at his home, 70 Harbor Street, in Glencoe, Ill., early in the morning of July 26. An Englishman by birth, Mr. Sargent had made numerous trips to his native country. One of these was made in April and May of this year in company with his close friend Samuel Insull. Mr. Sargent was taken ill while abroad, and one of his sons and his daughter met him at New York and brought him home to Chicago. He was removed to a hospital, but the doctors were able to do little for him, and he was taken to his home, where the end came at 2:30 a.m. on Saturday, July 26.

FREDERICK SARGENT

### His Early Life

Frederick Sargent was born in Liskeard, Cornwall, England, on Nov. 11, 1859. His people were of the farming class, but young Sargent developed a decided mechanical bent, and eight years of his boyhood and youth were spent in acquiring practical mechanical knowledge and experience in the works of John Elder & Company, the great shipbuilders on the River Clyde, near Glasgow. At this time he gained an extensive and practical knowledge of mechanical engineering, paying particular attention to heavy machinery. He improved his education at this time by going to night school at Glasgow University.

Coming to the United States about 1880, the young man found ready employment in Eastern shipbuilding yards as a designer of steam engines. He then went West as a designer for the Sioux City Engine Company of Sioux City, Iowa. This was his early home. He was married there, bringing his bride from his former home in Cornwall. A year or so later he accepted a position with E. P. Allis & Company, engine builders of Milwaukee, predecessors of the present Allis-Chalmers Manufacturing Company of that city. There he attracted the attention of the officers of the Western Edison Light Company, organized in Chicago in 1882 to exploit the electric lighting inventions of Thomas A. Edison in the West, and in the fall of 1884 Mr. Sargent went to Chicago and began his career as an electrical engineer in that city.

Succeeding the Western Edison Light Company, the Chicago Edison Company was formed in 1887. This was the first distinctively Edison central-station company in Chicago. Mr. Sargent became its consulting engineer, and he had been consulting engineer of that company and its successor, the present Commonwealth Edison Company, ever since.

### Entrance Into Central-Station Work

About 1889 Mr. Sargent went to New York under contract with the Edison United Manufacturing Company. In this position he had general charge of all the work done by that company in the United States and Canada. Shortly after this the company in New York was reorganized as the Edison General Electric Company, and Mr. Sargent was made assistant chief engineer of the new corporation, of which Samuel Insull was vice-president in charge of manufacturing. But Mr. Sargent had determined to open an office of his own, and in August, 1890, he returned to Chicago and established himself as an independent electrical and mechanical engineer. The firm of Sargent & Lundy was formed in 1891, Mr. Sargent being the senior partner from its organization to the time of his death.

In 1891 and 1892 Mr. Sargent was consulting electrical engineer for the World's Columbian Exposition of Chicago, and he designed the power plant and had much to do with the other mechanical and electrical features of the great World's Fair of 1893. Mr. Sargent made the plans for the machinery layout of the original Edison central station in Chicago, built about 1889. In 1892 Samuel Insull went to Chicago as president of the Chicago Edison Company, and that company at once took on a new lease of life. Under Mr. Insull's direction the old Harrison Street station was built with Mr. Sargent as designer. Mr. Sargent also designed the Fisk Street, Quarry Street and Northwest generating stations of the Commonwealth Edison Company.

### Builder of Monumental Stations

Mr. Sargent was one of the first electrical and mechanical engineers to recognize the great part that the steam turbine was destined to play in the development of electric generating stations. The Fisk Street station, the pioneer of all the large turbine central stations of the world, became deservedly famous for its many original features of design and for simplicity and economy of operation. After this station had been

in operation for a short time, Mr. Sargent was sent to London as a representative of the United States on the hearing in Parliament in connection with the London power-supply bill. This hearing crystallized in Mr. Sargent's mind some ideas he had been developing about the importance of unified power supply for great industrial centers so as to reduce the cost of production, and on his return he submitted his ideas to Mr. Insull, and they were worked out in the power station development of the Commonwealth Edison Company.

Mr. Sargent's engineering work was not confined to Chicago. He was consulting engineer for many of the important electric light and power companies throughout the country, including the Edison Electric Illuminating Company of Boston, the American Gas & Electric Company of New York, the Electric Bond & Share Company of New York, the Union Gas & Electric Company of Cincinnati, as well as many smaller organizations.

He designed the combined central power station of the American Gas & Electric Company and the West Penn Power Company on the Ohio River north of Wheeling, W. Va., which is one of the first large electric stations to be built in a favorable locality on a coal mine for the distribution of power to industrial centers at long distances. He designed the new station of the Union Gas & Electric Company at Cincinnati, which has recently been completed. He also designed the new station for the Kansas City Light & Power Company, which is soon to be put into operation. Mr. Sargent went to Chile in 1916 as consulting engineer for the Guggenheim mining interests on the development of a power supply for their mine at Chuquicamata.

During the recent war Mr. Sargent was consulting engineer for the power station of the Edgewood Arsenal at Edgewood, Md., and also consulting engineer for the United States government in other war-time projects demanding the application of power on a large scale.

### PROFESSIONAL ATTAINMENTS

In his profession Mr. Sargent was noteworthy for the clear vision and strong common sense with which he grappled with the essentials of an engineering problem. He was simple, clear, direct and practical. He was a man of broad outlook, tolerant, modest, seeking results rather than to uphold theories. And he was eminently successful in obtaining results, for his electrical generating stations were milestones of achievement in the economical production of electrical energy. He stood in the front rank of those men whose efforts have made electricity cheap for the people—an every-day necessity in the homes and factories of the United States.

Mr. Sargent was a man of absolute integrity and fearless independence in all his work. He had an infallible intuition regarding engineering matters, and those guiding the companies for which he did engineering work felt that his preliminary judgment was of greater value than even the mature study of most engineers. He had a remarkable combination of extreme daring and careful conservatism. With a broad and ambitious view of important and fundamental principles of his engineering work Mr. Sargent combined an accurate knowledge of all the underlying details, and no detail was too small for his personal attention.

He kept in close touch with everything that was new in the engineering profession. He was a great traveler and made repeated trips to Europe as well as through this country in order to post himself on the important developments not only in direct line of his own work but in all departments of the engineering field.

He had an idealism that was almost visionary and was very ambitious for the highest achievements in his work, but his idealism was held in restraint by a practical common-sense judgment. These qualities combined to give a distinct originality to every new power station which he designed and made it systematic, harmonious, economical and a perfect working machine.

### WARM TRIBUTES TO MR. SARGENT

Samuel Insull, for whom Mr. Sargent did much of his most important work, held his engineering ability in high estimation. In a speech delivered in December, 1911, Mr. Insull spoke of Mr. Sargent as "at the head of his profession, the electrical engineering profession, in this community, and the designer of our wonderfully economical central stations." Again, in a speech delivered on April 28, 1912, Mr. Insull referred to Mr. Sargent as "the most distinguished designer of central stations in the world." In another speech, delivered on June 26, 1912, and referring particularly to the introduction of steam turbines into electrical generating stations, Mr. Insull said: "I can well remember, as a result of a trip made by Frederick Sargent, our consulting engineer, and Louis A. Ferguson, our second vice-president, to Europe, I think about the year 1899 or 1900, that I was ready to listen with a more receptive ear to the suggestion of Mr. Coffin, president of the General Electric Company, that he should build a steam turbine of the Curtis design for one of our Chicago stations." This referred to the Fisk Street station.

To Mr. Sargent a medal was awarded by the World's Columbian Exposition in 1893. He was also a member of the jury of awards in power engineering at the St. Louis Exposition of 1904. He was a member of several societies and clubs, including the American Society of Mechanical Engineers, the Western Society of Engineers, the University Club, the Chicago Yacht Club and Skokie Country Club and the Engineering Club of New York.

Mr. Sargent was married to Miss Laura S. Sleep of Sioux City, Iowa, in 1885. The widow, one daughter, Miss Dorothy Sargent, and two sons, Chester Sargent and Ralph Sargent, survive. The funeral services were held on Monday at 1 p. m. at the family residence, burial being in Sioux City, Iowa.

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## INSULL BEARS TRIBUTE TO SARGENT'S WORTH AND SKILL

### The Dean of the Central-Station Fraternity Says that the Industry Has Lost Its Greatest Engineering Leader

"I have been on terms of close intimacy with Frederick Sargent for well nigh thirty-five years. During the greater portion of this period he has been solely responsible for the engineering design of the various central-station plants erected for the organizations under my management.

"To my mind, Sargent was a real engineering genius, and the modern central station is a monument to that fact. In his death the central-station industry has lost its greatest engineering leader. Apart from the work of the designers of reciprocating engines and the inventors of steam turbines and other apparatus, no one

else has contributed so much to the high efficiency of the modern central station as Frederick Sargent."

This is Samuel Insull's spoken tribute on the death of Frederick Sargent, a man he considered a great engineer and a warm friend. But more expressive perhaps have been the monuments to Mr. Sargent's engineering ability. Mr. Insull and other public utility executives have directed the investment of hundreds of millions of dollars in power plants designed by Sargent in the full belief that the designs were the best obtainable. Moreover, it is held that the correctness of this belief is borne out by the fact that in all the world there are no steam power plants which, year in and year out, have shown higher operating efficiency than those designed by the great engineer who has just died.

## CENTRAL STATIONS GREATLY INDEBTED TO SARGENT

### His Work as Consultant and Designer Counted for Much in Improved Steam-Turbine Operation and Station Efficiency, Says Byllesby

The following appreciation of Frederick Sargent was given to a representative of the ELECTRICAL WORLD by Col. H. M. Byllesby of Chicago, with whom Mr. Sargent was closely associated in his younger days.

"Frederick Sargent stood in the forefront of eminent mechanical engineers. He has left as a monument his work in every branch of steam engineering. He was of English birth and had received wonderful and thorough training in the fundamentals of mechanical engineering before reaching the United States.

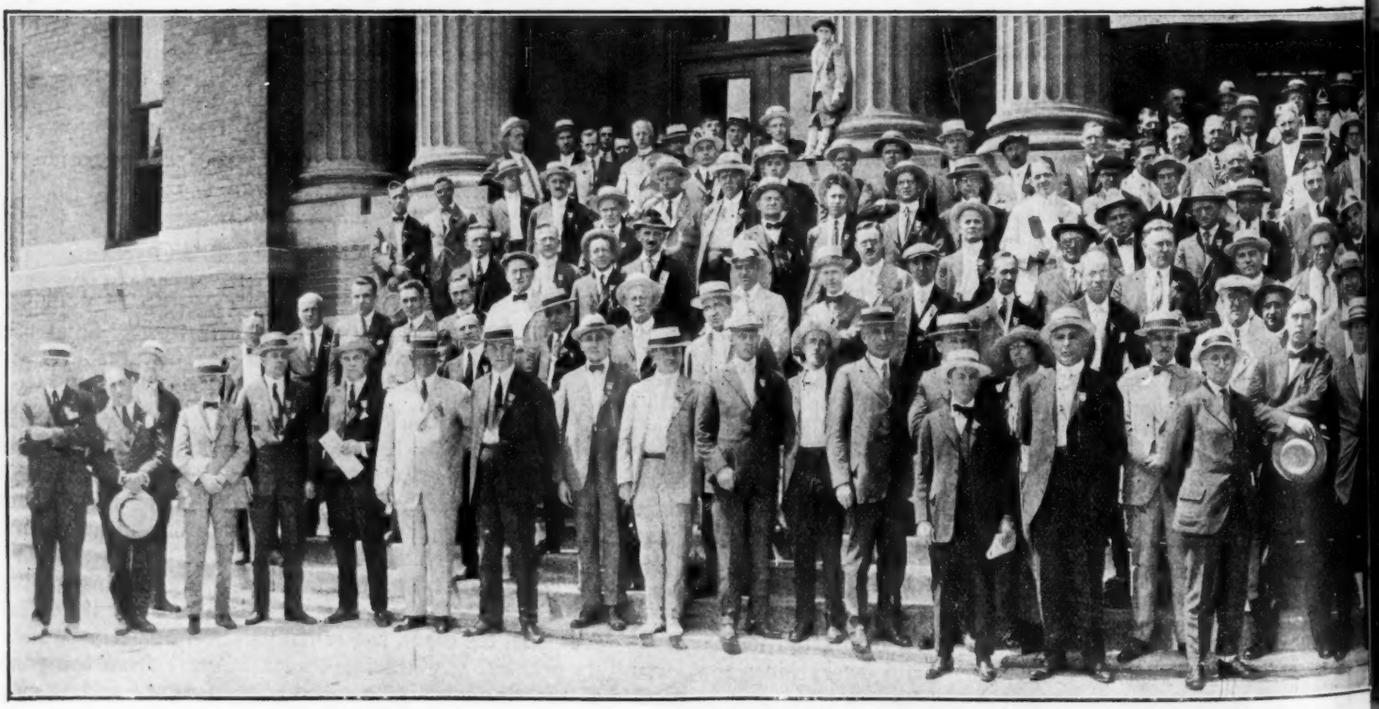
"Combined with great natural talent, deep study and high scientific attainments, he possessed to a marked degree the inborn instincts of a steam engineer. He was intensely practical, resourceful and courageous. The rapid development of the steam turbine is in part, probably in large part, due to his practical work as a consultant and as a designer, and above all else as a practical operator of steam turbines and their accessories in the modern power house. The modern steam electric power house is very largely a product of Mr. Sargent's designs and comprehensive views.

"In addition to his fine abilities professionally, he was a high type of gentleman, universally respected, and the profession has suffered a tremendous loss in his death at a comparatively early age. My first acquaintance with Mr. Sargent was in 1881, when he succeeded me in the drafting office of Robert Wetherill & Company, Chester, Pa., upon my leaving that firm to go in the drafting department of the Edison Illuminating Company of New York City, and again some few years later when I left the service of the Edison company, at which time Mr. Sargent again succeeded me."

## WORCESTER SUBURBAN COMPANY VOLUNTARILY REDUCES RATES

### Co-operation of Customers During War Period Leads Company to Share Its Prosperity Despite High Cost of Operation

The Worcester (Mass.) Suburban Electric Company, serving about 5000 customers in the southern portion of Worcester County, has announced a downward revision of both lighting and power rates, effective on July and subsequent bills. Formerly the lighting rate was 15 cents per kilowatt-hour and the power rates carried a war surtax of 10 per cent. The new lighting rate will be 15 cents gross per kilowatt-hour of primary usage and 13 cents net per kilowatt-hour for secondary usage. A discount of 1.5 cents per kilowatt-hour for payment within ten days of receipt of bill for electricity consumed during the previous month on the primary usage rate will now bring the net rate for the primary usage to 13.5 cents per kilowatt-hour. The power surtax will be reduced to 15 per cent. In a



GROUP OF DELEGATES IN ATTENDANCE AT THE RECENT CONTRACTORS

statement issued by O. E. Wolcott, superintendent, the following comment appeared:

The coöperation which this company has received throughout the very trying period of the war from town officials, citizens and manufacturers in the territory which we serve, in helping us to build up the greater use of electricity, enables us at this time to announce a reduction in the price of electricity for lighting. We have had this reduction under consideration since the signing of the armistice, but owing to the costs of nearly every item used in the manufacture and distribution of electricity remaining consistently high, it has been difficult to find a way to make the reduction. However, in recognition of the coöperation received, we believe it is our duty as a public service corporation to show appreciation in a material way. . . . In making this voluntary reduction, however, we must ask that it be clearly understood that this cut is not due to any material lessening in costs and we must therefore reserve the right to increase the rate if there is an increase in cost.

It will be the policy of the company in the future, as it has been in past, to try to share with its customers in a fair way any growth in earnings that it may secure. We respectfully wish to call the attention of the public to the fact that we were one of the last companies in the state to increase rates in the face of the rapid increase of war costs, and are now one of the first and few concerns to make a reduction in the face of sustained war costs.

The company purchases its energy from the New England Power Company.

## SECOND RATE INCREASE FOR MOUNT WHITNEY COMPANY

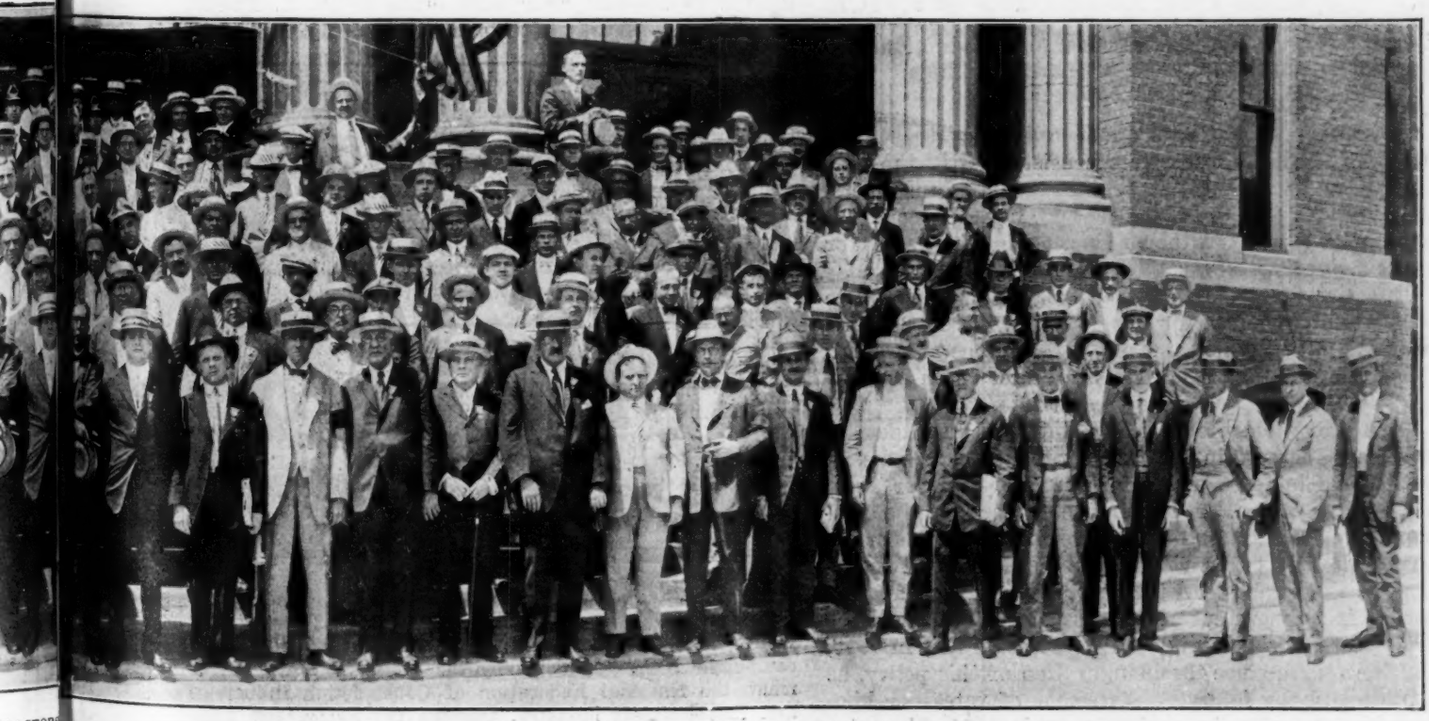
### California Railroad Commission in View of Present Abnormal Conditions Grants an Additional Surcharge of 5 Per Cent

On the broad ground that upon adequate and efficient distribution of electric energy largely depends the development of the great San Joaquin Valley, and basing its decision on the necessity that an adequate return be granted and on the belief that the consumers served by the Mount Whitney Power & Electric Company will gladly meet their responsibility by paying fair and reasonable rates for service, the Railroad Commission of the State of California recently granted the request of the company for authority to increase its rates for electrical energy.

The decision gives the utility power to substitute a 15 per cent surcharge for the surcharge of 10 per cent that was previously allowed the company, to enable it to meet increased costs under present abnormal conditions, which is equivalent to a net increase at this time of 5 per cent. The new rate became effective July 15. The estimated gross revenue of the company for the year 1919 is $1,230,000 without the surcharge. For the first six months of the year the surcharge will be 10 per cent and for the last six months 15 per cent.

Approximately 80 per cent of the company's business is the service of power for agricultural pumping, the majority of which is in Tulare County. Most of the pumping business has heretofore been handled on a flat rate per horsepower per month. In its recent order the Railroad Commission has authorized a new schedule for power service to pumping plant consumers upon a meter basis. The acceptance of the new schedule will be optional with the consumer.

At the time the Mount Whitney Company made its application for a second increase in its rates there was formed by protestants what was termed the San Joaquin Valley Public Utility Association, said to comprise over 1000 power consumers of the company's system, and this association employed engineers and attorneys who submitted at the second hearing a complete study of the situation, with the view of preventing the increase in rates. In its order the commission commended the work done by the Public Utility Association and assistance given in getting at all of the facts. Various complaints were made regarding the quality of the service delivered on certain parts of the system, and the Mount Whitney company has arranged to make



NVENTION IN MILWAUKEE, PHOTOGRAPHED ON STEPS OF AUDITORIUM

liberal expenditures which will result in a standardization of service and quicker action when troubles occur.

The Mount Whitney Power & Electric Company is a subsidiary of the Southern California Edison Company. Owing to the relatively small precipitation of rain in the mountains during the last two winters, and also to the abnormal demand for electric power for agricultural purposes, there is at the present time a shortage of power in the San Joaquin Valley. The Southern California Edison Company has been called upon to make up this shortage, not only for the Mount Whitney Company but also for the system of the San Joaquin Power & Electric Corporation. This condition was taken into consideration by the Railroad Commission in making its order, in the following paragraph:

The shortage of power supply on the San Joaquin system has become so acute that it is absolutely necessary that the interconnection of these systems be made during the latter part of this year in order to protect the interests of the farmers in the valley. The result of this interconnection will be that the Mount Whitney consumers will not obtain fully the class of service which applicant promised at the hearing in this application. The commission has, however, given this matter careful consideration and has concluded that its duty to the general service in the entire San Joaquin Valley is to make possible the full use of all facilities of the electrical utilities so that no drastic action would be necessary on the company's part in discontinuing consumers, the result of which would probably be a greater loss to the San Joaquin Valley in total than the inconvenience which would result from a few additional interruptions on the Mount Whitney systew. We are certain that the consumers on the Mount Whitney system will be fully in accord with this position.

By the commission's order the rates on the H. G. Lacey Company's system in Hanford and adjacent territory, which property was recently acquired by the Mount Whitney company, are subject to the same surcharge as the Mount Whitney company's schedules.

## MONTREAL UTILITY REDUCES RATES FOR LIGHTING SERVICE

### Despite Heavy Increase in Cost of Production and Distribution, Company Shares Earnings with Its Customers

In conformity with its announced policy to sell its products at the lowest prices consistent with the best service, and to share its earnings with its customers, the Montreal (Que.) Light, Heat & Power Consolidated will make a still further reduction in the rates for electric lighting service.

Effective from the October meter readings, the rate on five-year contracts for such service will be 4.80 cents per killowatt-hour net, instead of 5 cents as at present, thus giving consumers the benefit of a reduction amounting to 2½ per cent below the present rate.

This reduction, the company states, is made despite the heavy increase in the cost of production and distribution—an increase which for the item of labor alone amounts to $400,000 a year in the expenses of the company. While war conditions have forced up the prices of practically all commodities, this is the second reduction in rates made by this company during the war period, including a cut of 5 cents per 1000 cu ft. in the price of gas, bringing it down to 80 cents net, in 1916, and the fourth since the inauguration of this policy, as is shown in the following statement of rates per kilowatt-hour net for the periods named: 1911, 7½ cents; 1912, 7 cents; 1913, 6 cents; 1914, 6 cents; 1915, 6 cents; 1916, 5 cents; 1917, 5 cents; 1918, 5 cents; 1919 4.80 cents.

Domestic users of gas and electricity who take both services from the company are entitled to the "dual service" discount of 5 cents per 1000 cu. ft. of gas consumed. The advantages of "dual service," in addition to the lower price, are that consumers avoid unnecessary traffic in their homes and have only one meter reading, one account and one payment to make.

Five-year contracts for electric lighting service are subject to cancellation by the consumer without indemnity, in the case of commercial houses in the event of the consumer giving up business, and, in the case of residences, in the event of the consumer giving up housekeeping or removing to territory beyond the company's limits to supply.

## NEW JERSEY CONTRACTORS AND DEALERS CONVENE

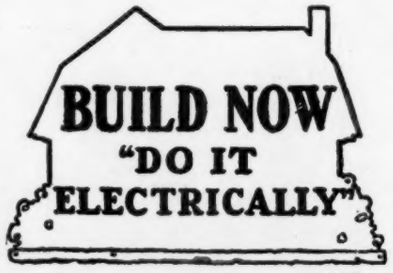
### Public Utility Men and Manufacturers Contribute in Large Part to an Interesting Program at Asbury Park Meeting

The New Jersey Electrical Contractors and Dealers' Association met in annual convention at Asbury Park, N. J., last Saturday. Among the topics up for discussion was a new set of rules to be drawn with the idea of bringing uniformity in specifications, contracts, etc., between contractors and public utility corporations, so that a contractor will have no difficulty in submitting bids on work in any part of the state. These rules will be up for adoption at a meeting to be held Jan. 1, 1920, at which time new officers will also be elected.

It was also decided to have three branches of the New Jersey Electrical Contractors and Dealers' Association in different sections of the state, so as to encourage contractors to join and attend meetings.

At an open meeting to which manufacturers, jobbers and central-station representatives were invited speeches limited to one-half hour were made by A. L. Powell, Edison Lamp Works of General Electric Company, on "Lighting and Illumination"; Samuel Chase, Westinghouse Electric & Manufacturing Company, on "Live and Help Live"; Farley Osgood, Public Service Electric Company, on "Contractors' Responsibility to the Public," and F. D. Pembleton, Public Service Electric Company, on "Merchandising."

## Build Now and Make It Electrical




James M. Wakeman, general manager of the Society for Electrical Development, urges the industry to tie in closely with the nation-wide "Build now" and "Own your home" campaigns being conducted by the United States government, the National Federation of Construction Industries and the electrical industry, through the Society of Electrical Development. The picture which is reproduced is being distributed by the society.

## *Commission Rulings*

**Important decisions of various state bodies involving or affecting electric light and power utilities.**

**Utility Commission Holds It Has Power Over City Plants.**—The Board of Public Utility Commissioners of New Jersey has ordered the borough officials of Madison to make a number of improvements in the municipal electric plant and system, so as to provide safe and adequate service. The city held that the commission had no power to make an inspection of the plant or to direct any betterment work. The board says: "The observance of the recommendations is resisted by the municipality on the ground that this board has no power over its electric plant because it confines its service to the municipal limits and does not serve consumers outside thereof. They fear the encroachment of powers reposed exclusively in them. The section of the law conferring the authority, however, makes it the duty of the board to see that its standards of service are maintained alike by public utilities and municipalities engaged in operating public utilities, so that the public served may be insured safe, adequate and proper service."

**Discriminatory Power Contracts.**—In authorizing increased rates to provide a net return of approximately 8 per cent on the value of the investment of the Appalachian Power Company, the West Virginia Public Service Commission directed the modification of power contracts possessing discriminatory features. It said in part on this subject: "It is charged by protestants and shown by the evidence that the rates of applicant now in effect are discriminatory as between certain of its power consumers, and this is especially true as to its contracts with the protestants, Carter Coal Company and Pocahontas Fuel Company. From applicant's evidence we find that the Carter Coal Company should pay $2,000 per year additional and the Pocahontas Fuel Company from $10,000 to $20,000 per year additional for the service now being rendered, at the rates now in effect, to place them on an equality with applicant's other consumers of like character. . . . Inasmuch as other considerations than the rate granted enter into these contracts, we are unable to determine from the facts before us just what adjustment should be made in relation to the rates of applicant's various consumers in order to place them upon a non-discriminatory basis. We are of the opinion that the applicant should at once proceed to modify and revise all of its contracts possessing such discriminatory features . . . Upon the failure or refusal of the applicant, or in the event of its inability to modify said contracts so as to eliminate all unjust discrimination as between its consumers in like class, the commission will, upon its own motion, enter upon an investigation of said contracts and make such order in respect thereto as may seem just, reasonable and proper."

**Valuation of Unused Water-Power Sites and of Steam Plant.**—Valuation of unused water-power sites and of a steam plant constructed by the Appalachian Power Company was considered by the West Virginia Public Service Commission in a recent decision. Regarding these two matters the commission handed down a decision from which the following extract, covering its scope, is made: "It appearing that a reasonable forecast of the development of the business of applicant justified the acquisition of said unused sites at the time the same were purchased, we are of opinion that the value of said unused sites should be carried as a deferred capital charge, and, when put into use, charged to capital investment at the original purchase price plus the accumulated interest upon said investment, and that the applicant's consumers using the energy generated from said sites should be required to pay a reasonable return thereon rather than ratepayers of the present period. . . We are unwilling to undertake to substitute our judgment for the business sagacity and foresight of the managers of the applicant company which dictated the construction of this steam plant at this time. It does appear from the evidence that the applicant has been able to supply the demands of all of its present consumers from its plant capacity now installed; that the demand during the past year amounted in round numbers to 95,000,000 kw.-hr. However, a reasonably prudent regard for power requirements incident to the rapid development of the region in which the applicant operates would, in sound business judgment, require that the capacity of the applicant be kept somewhat in advance of the immediate demands of its consumers. The applicant as a public service utility is required to be ready to supply adequate service and facilities upon reasonable terms and conditions to all who apply therefor within the territory served by it, and its failure to maintain a capacity slightly in advance of its immediate requirements would render it incapable of performing its public duty in this respect. We are unable to say from the evidence that the applicant, when this plant is completed, will have a greater capacity than a proper regard for the demands of its present and prospective consumers will require, but inasmuch as the applicant is entitled to charge as a part of its capital investment interest upon its incomplete construction, we are of opinion that the investment in such incomplete construction should not be made a part of the rate base as to present consumers until actually put into operation."

## *Associations and Societies*

**A complete Directory of Electrical Associations is printed in the first issue of each month.**

**Oregon Society of Engineers.**—On June 27 the society held a house warming at its new club quarters in Portland.

**Northwest Electric Light and Power Association.**—The annual convention of the association is to take place in Seattle from Sept. 10 to 12.

**Colorado Electric Light, Power and Railway Association.**—The annual convention of this association is to be held at Glenwood Springs from Sept. 18 to 20.

**Denver Electrical Contractors' Association.**—E. C. Headrick and C. N. Shannon are the newly elected president and secretary, respectively, of this association.

**Electric Club of Chicago.**—H. A. Mott, general chairman of the outing committee, Electric Club of Chicago, has announced that this year's picnic and summer party will be held at Ravina Park on Aug. 21.

**A. I. E. E., San Francisco Section.**—A tentative program to be followed by the committee on railway electrification, San Francisco Section, American Institute of Electrical Engineers, has been outlined in the report made by the subcommittee on scope and program, of which Robert Sibley is chairman. As outlined by this sub-committee, work will be taken up by the committee on electrification from the viewpoint of gathering reliable data and drawing conclusions to aid in public enlightenment on the economies, advantages and disadvantages of railway electrification and its relationship to the march of progress.

**A. I. E. E., Lynn Section.**—The executive committee of the Lynn Section, American Institute of Electrical Engineers, has submitted for the approval of the section members an amendment to the bylaws creating the offices of vice-chairman and assistant secretary as well as rearranging the personnel of the executive committee. By the proposed change the vice-chairman would not only assist the chairman during his first year on the executive board of the section, but would become eligible for the chairmanship during the second year and as past-chairman during the third year would act in an advisory capacity. According to the proposed plan the assistant secretary would help the secretary-treasurer and would become eligible for the secretaryship the following year. Thus a system of promotion of section officers would be inaugurated.

## *Current News and Notes*

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

**Arbitration of Public Service Labor Questions.**—The Central Labor Council of Waco, Tex., has submitted resolutions to the Governor of Texas urging him to advocate compulsory arbitration of labor disputes in public service corporations.

**Hydroelectric Investment Opportunity in Mexico.**—The commercial agent of Mexico at St. Louis, C. I. Luque, states that Salvador C. Luque of Pachuca, Mexico, has sent to the office of the commercial agent a prospectus of a concession granted by the Mexican government for hydroelectric purposes. This concession gives the right to the use of 2000 liters of water per second from a certain river in the State of Hidalgo. S. C. Luque desires to interest American capitalists in financing this proposal. Mr. Luque states that he will readily give all desired information relating to the project to those showing active interest.

**Service of California Utility.**—In connection with the recent sale to Blyth, Witter & Company, San Francisco, of $5,000,000 preferred stock of the Pacific Gas & Electric Company, A. F. Hockenbacker, vice-president of the company, summarized the company's growth and the present scope of its activities. Operation extends over thirty counties of northern and central California, having an area of 37,375 square miles and a population, according to the 1910 census, of 1,325,637. The present population of the area is estimated to be 1,825,000. The company serves seven of the largest cities of the state—San Francisco, Oakland, Sacramento, San José, Stockton, Berkeley and Fresno. Directly or indirectly it serves 176 cities and towns with electricity, 49 with gas and 17 with water, and it also operates a street railway in Sacramento.

**Available Water-Power Supply in Sweden.**—Sweden's total supply of water power is estimated in a recently published report of the Board of Trade at 6,700,000 hp. available during nine months of the year. The amount suitable for use under conceivable economic conditions is placed at 3,500,000 hp., of which about 700,000 hp. is in the possession of the state and 2,800,000 hp. in private ownership. The use of hydroelectric energy is facilitated by virtue of the large number of Swedish lakes available for the storing and regulation of seasonal water. The Board of Trade finds that three-fourths of the horsepower now in use is employed in the development of electricity. Of the 2,000,000,000 kw.-hr. produced in 1916, 1,250,000,000 was used as driving power for industry, 631,000,000 for electrolytic and smelting processes, 89,000,000 for household purposes, and 33,000,000 for traffic. Cost of equipment for the works under review was found to amount to an average of approximately $65 per horsepower. The cost of production varies widely according to size of plant, being $94 per horsepower in plants equipped for less than 500 hp., and in plants of 10,000-hp. capacity being slightly over $42 per horsepower.

**Seek Extension of Pacific Cable Service.**—With a view to devising means of improving cable and wireless communication across the Pacific Ocean, the Foreign Trade Council has appointed a special committee on foreign communications. The members of the new committee are E. P. Thomas, president United States Steel Products Company; Howard E. Cole, director Standard Oil Company of New York; R. P. Tinsley, vice-president American International Corporation; M. A. Oudin, vice-president International General Electric Company; R. H. Patchin, manager foreign trade department W. R. Grace & Company; Frederick J. Koster, former president San Francisco Chamber of Commerce, and William Pigott, president American Car & Foundry Company. The board's statement announcing the formation of the committee declared that the continuation of the present inadequate service across the Pacific would put American business men at a disadvantage compared with those of Europe.

**Power Business of Pennsylvania Company Shows Increase.**—The annual report of John H. Pardee, president of the Eastern Pennsylvania Railways Company, for the year ended Dec. 31, 1918, states that the increased demand for wholesale power has taxed the generating plant of the company to its utmost, and with a further amount of new business in sight it is imperative that additional apparatus should be installed immediately. The company's officers are giving the question careful study and are endeavoring to devise satisfactory plans for providing the much needed equipment. The earnings from wholesale power for January, 1918, were $3,890, and in December, 1918, they were $16,920. The kilowatt-hours used by wholesale customers in January, 1918, amounted to 385,106 and in December, 1918, 1,153,375. During the year 9490 hp. in motors was connected to the company's system, and about 4000 hp. additional will be connected during the year 1919 under contracts made in 1918. Most of the power is used in connection with mining for anthracite coal. The report states that increases in electric rates were made in August, 1919 and in November, 1918. The increases as regards rates for wholesale power were made under agreement with large power consumers. Some opposition has developed from the increase in retail rates, but up to the present time it has not been of such a nature as to cause them to be set aside.

## *Recent Court Decisions*

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

**Injury from Electric Shock.**—In an action for injury from an electric shock received from a defendant's telephone instrument, the action of other companies as to character of fuses used in connection with lightning arresters could not govern defendant, though it might be considered in deciding whether defendant's arrester was one fit for the purpose, according to the Kansas Court of Appeals.

**Injury from Adjacent Telephone and Power Line Poles.**—The Supreme Court of New York (176 N. Y. S. 281) has held that where a boy climbed a telephone pole and crossed over to an electric power pole standing near it and was injured by highly charged wires thereon, negligence of the telephone company could not be predicated on its act in placing its pole close to that of the power company, and its own wires not being highly charged, it was not bound to foresee injury from wires not its own.

**Liability to Boy Injured in Climbing Poles.**—Where a power company, under proper authority, maintained a pole and wires near a school, with steps on the pole leading to insufficiently insulated wires, it is not liable to a boy injured by contact with the wires in climbing the pole, on the ground of nuisance, according to the Supreme Court of New York (176 N. Y. S. 281). It is pointed out, however, that a power company owes a common-law duty to the public to exercise a care commensurate with dangers to be apprehended, which would include the duty of avoiding steps on poles accessible from the ground so as to prevent children and others from reaching the live wires.

**Binding Effect of Franchise.**—According to the Supreme Court of Arkansas, a franchise grant by a city council to a public service company to supply water and light to the city and its inhabitants at certain rates, when accepted, becomes a contract between the city and the grantee, the conditions of which are binding as in any other contract both on the city and on the company. The court also pointed out: (1) that such a contract between the municipality and the company may be modified by an ordinance, properly passed, raising the water and light rates, when accepted by the company; (2) that a city council, in the exercise of its legislative power, as in granting or modifying a water and light franchise, is vested with a discretion which can be controlled by the courts only after abuse.

# *Men of the Industry*

Changes in Personnel and Position— Biographical Notes

**James R. Angell** has been elected chairman of the National Research Council to take the place of Dr. G. E. Hale.

**Orville R. Toman** has returned to his position as superintendent of construction of overhead lines and substations with the Continental Gas & Electric Corporation at Omaha, Neb., after two years' service in the Signal Corps. Mr. Toman was in France with the 109th Signal Battalion, specializing in radio-telegraphy and radio-telephony.

**M. S. Sloan** has been elected president of the Brooklyn Edison Company following the resignation of Nicholas F. Brady from that position. Mr. Sloan since the latter part of 1917 has been operating manager of the New York Edison Company. Previous to that he held the position of vice-president and

M. S. SLOAN

general manager of the New Orleans (La.) Railway & Light Company. Mr. Sloan is a graduate of the Alabama Polytechnic Institute, and from 1906 until late in 1913 was employed by the Birmingham (Ala.) Railway, Light & Power Company. During this time he rose from chief engineer to assistant to the president, assuming the latter office in 1910, when he took supervision over all departments. Toward the end of 1913 he resigned to join the executive staff of the New Orleans company, a property affiliated with the Birmingham company.

**Harold D. Larrabee** has been appointed general manager of the Eastern Connecticut Power Company, with headquarters at Norwich, Conn. He took up the duties of his new position on Aug. 1. Mr. Larrabee is well known in the New England public utility field. He was graduated from the Massachusetts Institute of Technology in 1902 and for the past ten years has been general manager of the Barre & Montpelier Light & Power Company of Vermont, one of the properties under the management of Charles H. Tenney & Company of Boston. The Barre & Montpelier Traction Company was also under Mr. Larrabee's management during his term of service in the Green Mountain State. At Norwich Mr. Larrabee will have general charge of a 22,000-kw. generating plant interconnected by transmission tie line with the system of the New England Power Company and supplying the principal municipalities of southeastern Connecticut with electrical energy.

**I. B. Zimman**, formerly manager of the sales and service department of the Nebraska Power Company, has been made assistant general manager in charge of public relations. Mr. Zimman will supervise matters of the company concerning general relations with the public, franchises, municipal contracts, taxes and property assessments. He has been connected with the company for a number of years in new-business work.

**Frank S. Easton**, hydroelectric engineer with the British Columbia Electric Railway Company, Vancouver, B. C., has resigned to enter the employ of the Mexican Light & Power Company, with headquarters at Mexico City, Mex. Mr. Easton will have charge of certain hydraulic and electrical work for the company under the direction of G. R. G. Conway, managing director, who was formerly chief engineer of the British Columbia Electric Railway Company.

**Prof. Charles J. Tilden** has been placed in charge of a new department in the Sheffield Scientific School at Yale University to be known as engineering mechanics. Professor Tilden from 1896 to 1903 served as instructor in the Lawrence Scientific School, in the Harvard Summer School of Engineering, and in civil engineering at Cornell University. During the years from 1905 to 1913 he was a member of the engineering faculty of the University of Michigan, and was promoted from the rank of instructor to head of the department of engineering mechanics. Later at Johns Hopkins University he was professor of civil engineering and head of the department and had charge of the construction of the new civil engineering building. In February 1917 he was commissioned captain in the U. S. Engineer Officers' Reserve Corps, and in June made secretary of the general engineering sections of the advisory committee of the Council of National Defense, which position he held during the existence of that section. In May 1918 he was appointed to the department of education and training, United States Shipping Board. Emergency Fleet Corporation, and placed in charge of education and training in districts 8 and 11 on the Pacific Coast. On Oct. 1, 1918, he returned to the Johns Hopkins University.

**George H. Waring**, who has recently been appointed vice-president and assistant general manager of the American Public Utilities Company, with headquarters at Grand Rapids, Mich., was formerly general manager of the Utah Gas & Coke Company of Salt Lake City, a subsidiary company. Mr. Waring was for a number of years connected in various capacities with the United Gas Improvement Company of Philadelphia, filling engineering, operating and executive positions. The last position he held with that company was vice-president and general manager of the Charleston (S. C.) Consolidated Railway & Light Company. In

G. H. WARING

1917 he resigned to join the American Public Utilities Company as general manager of the Utah Gas & Coke Company.

**W. S. Byrne** has been made sales manager of the Nebraska Power Company and assistant to I. B. Zimman, who has recently been appointed assistant general manager. Mr. Byrne will have charge of the entire sales department, including the company's electric shop.

**Warren B. Lewis** of Providence, R. I., has been appointed provisional manager of the Taunton (Mass.) municipal lighting plant. Mr. Lewis maintains consulting engineering offices in the Grosvenor Building, Providence, but will devote considerable time to problems of the Taunton plant. He has appointed E. J. Horrigan resident manager.

**William A. Baehr**, a consulting engineer of Chicago, through the purchase of the Southern Illinois Light & Power Company, Hillsboro, Ill., has been elected president of that company. Mr. Baehr takes up the duties of J. J. Frey of St. Louis, formerly president of the company. Mr. Frey, however, is retained as vice-president and a member of the board of directors.

# TRADE & MARKET CONDITIONS

## News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

## MAY ELECTRICAL EXPORTS AMOUNT TO SUM OF $7,717,518

### Figures for First Five Months Are Running at Rate of More than $90,000,000 for Entire Calendar Year

Exports of electrical merchandise during May amounted to $7,717,518, the second largest month on record. The only items in which records were hung up were rheostats, which amounted to $64,478, and miscellaneous supplies, which amounted $2,610,263. Exports of batteries, insulated wire and cable, motors and switches were large.

Canada, England and British South Africa were the leading factors in the month's battery trade; Norway, Brazil, Uruguay, Dutch East Indies and Cuba in insulated wire; Australia, Canada and Brazil in motors; Canada, Australia, New Zealand and British India in rheostats; Italy, Canada, Switzerland, Mexico, Brazil, Japan and Australia in miscellaneous equipment.

The totals for the first five months of the year amount to $27,591,622, or at an annual rate of over $90,000,000.

For the eleven months ended with May the totals were $69,698,590 in comparison with $49,527,442 for the corresponding period a year previous.

Figures in the accompanying table were compiled by the Bureau of Foreign and Domestic Commerce.

| | May | | Eleven Months Ended May | |
|---|---|---|---|---|
| Articles | 1918 | 1919 | 1918 | 1919 |
| Batteries | $308,895 | $516,001 | $3,079,522 | $4,012,920 |
| Carbons | 112,903 | 130,982 | 1,407,133 | 1,498,524 |
| Dynamos or generators | 443,331 | 257,908 | 2,554,620 | 3,508,557 |
| Fans | 120,930 | 201,125 | 653,852 | 1,166,200 |
| Heating and cooking apparatus | 48,492 | 146,765 | 484,803 | 1,030,335 |
| Insulated wire and cable | 344,186 | 838,188 | 5,390,628 | 7,239,702 |
| Interior wiring supplies, including fixtures | 140,050 | 179,931 | 1,393,504 | 1,645,546 |
| Arc lamps | 1,085 | 1,300 | 13,218 | 14,382 |
| Carbon-filament lamps | 10,459 | 44,157 | 140,776 | 161,018 |
| Metal-filament lamps | 308,908 | 434,894 | 2,706,748 | 3,934,990 |
| Magnetos, spark plugs, etc. | 160,395 | 291,415 | 2,999,615 | 2,800,784 |
| Meters and measuring instruments | 161,431 | 245,589 | 1,383,901 | 2,299,069 |
| Motors | 574,437 | 817,118 | 6,077,222 | 9,114,833 |
| Rheostats and controllers | 28,516 | 64,478 | 187,889 | 369,029 |
| Switches and accessories | 148,359 | 255,099 | 2,040,615 | 2,069,352 |
| Telegraph apparatus, including wireless | 32,339 | 70,296 | 282,638 | 672,791 |
| Telephones | 251,785 | 285,785 | 2,292,120 | 2,758,456 |
| Transformers | 214,958 | 326,224 | 1,879,773 | 3,984,524 |
| All others | 1,601,920 | 2,610,263 | 14,558,865 | 21,417,578 |
| Total | $5,013,379 | $7,717,518 | $49,527,442 | $69,698,590 |

## USE OF COMPENSATED SERIES MOTORS GROWS

### Type of Small Single-Phase Motor Developed for Printing Presses Now in Demand for Wide Range of Industrial Application

New applications are being found for the series-compensated single-phase motors in sizes up to about 5 hp. One manufacturer, whose entire output of this type of motor previously went to the printing trade, is doing more of such business than ever before, but nevertheless the printers are taking only a small percentage of his total output. The bulk of the output is now being taken by other industries. The dependence of manufacturers on the printing trade was thrown off by studying the market and pushing sales wherever the characteristics of the series motor suited the load.

This motor is now being sold in large quantities for testing magnetos and automobile-starting generators, also for operating valve mechanisms, fans, blowers, pumps, varnish clarifiers, motion-picture machines, static machines, flotation test machines, centrifuges, textile-finishing machines, cotter machines, spring machines, and small transfer locomotives in brickyards. This list does not include all the applications for which the series-compensated single-phase motor is suitable, but it gives some idea of the business possibilities outside the printing field. The addition of a centrifugal governor to the motor gives it adjusable speed characteristics which widen the scope of the motor's usefulness to include such applications as machine tools, embroidering machines, welding machines and type-setting machines.

## HIGH-TENSION INSULATOR MARKET MORE ACTIVE

### Orders for $1,500,000 Reported About to Be Placed— Prices Show No Recent Change, but Shipments Are Lengthening

The market for high-tension insulators has shown increasing activity, and great promise is held out for the near future. This is shown by the report that there are orders for about $1,500,000 worth of high-tension insulators in the placing at this time. The domestic market is opening up in good shape and the foreign market holds out extremely good hope. Projected European transmission lines form the basis for much of the foreign promise.

Prices have shown no recent change, but there is no promise given as to how long this condition will hold. However, no hope of a near decline is held out. Shipments of certain types of high-tension insulators may be made from stock, while shipments of other types are given at this time as thirty days. Manufacturers predict longer deliveries on account of increasing orders going through the factories and advise early ordering for any anticipated needs.

## SOUTHERN COLLECTIONS ARE NOW IN GOOD SHAPE

### Industrial Concerns, Municipal Plants, Jobbers, Etc., in Spite of Loosened Credit Rein, Have Comparatively Little Paper Outstanding

A review of the collection and credit situation in the Southern electrical market shows that bills are being paid with considerable promptness. This condition is remarkable when it is considered that the credit rein has been loosened slightly. It has generally been understood that when the South disposed of its cotton holdings there would be a general settlement of outstanding accounts, but that until then money would be rather scarce and credit required.

However, electrical manufacturers report excellent collections. One manufacturing house is collecting as high as 85 per cent of Southern bills receivable when due. Electrical supply jobbers are keeping their accounts cleaned up in good shape, and they have comparatively little paper

outstanding with the manufacturers. Jobbers and dealer contractors both state that their collections are very satisfactory.

Industrials are especially prompt in taking care of their obligations, and municipal plants are settling accounts beyond expectations.

## METAL MARKET SITUATION

### Upward Movement of Copper Meets Temporary Halt in Quiet but Firm Market

Copper prices have halted in their upward movement and are holding around 23.50 cents. The market is quiet but firm with the producers, while some of those who bought on speculation are inclined to shade the prevailing price a bit in order to realize on their holdings. In general, August and September copper is held for 23½ cents and the last quarter is placed conservatively at 24 cents a pound. Spot may be bought at a shade under 23 cents.

There has been great activity in August and September buying, but there is still much to be bought in the last quarter. Present needs of electrical manufacturers appear to be well cared for so that their buying for spot delivery will probably be rather light for a time.

The London copper market was up to £107 5s. for spot delivery, but has retreated to £104 10s.

Copper and brass products have increased over last week around 1 cent.

The War Trade Board section of the Department of State announced on July 24 that the date on and after which pig tin and all metal alloys containing tin may be imported from points other than points of origin and without reference to date of shipments has been advanced from Sept. 1 to Aug. 15. On and after Aug. 15 the above metals will be imported into the United States under General Import License PBF-37.

There has been good domestic buying of tin this past week and much speculative buying in London. The domestic price is set at 70 to 71 cents, while London prices have stiffened appreciably.

Lead has been marked up to 6 cents a pound in New York, but the market is quiet. Speculative demand has fallen off for the present and consumers' buying is below recent high levels.

The market in spelter has eased off considerably with a decline to 7.90 cents, and buying has been light. Sheet zinc is up ¼ cent to 10.50 cents.

Scrap coppers have increased to 20½ to 21 cents, a jump of 2 cents over last week. There is good buying in this market. Light brass advanced ¼ cent. Lead scrap followed the raw metal upward ⅛ cent.

### NEW YORK METAL MARKET PRICES

| | July 23 | July 30 |
|---|---|---|
| Copper: | £ s d | £ s d |
| London, standard spot | 104 15 0 | 104 10 0 |
| | Cents per Pound | Cents per Pound |
| Prime Lake | 23.50 to 24.00 | 23.50 |
| Electrolytic | 23.50 | 22.75 to 23.50 |
| Casting | 22.75 to 23.00 | 22.25 to 22.50 |
| Wire base | 25.50 | 26.00 |
| Lead, trust price | 5.75 | 6.00 |
| Antimony | 9.37½ | 9.25 |
| Nickel, ingot | 40.00 | 40.00 |
| Sheet zinc, f. o. b. smelter | 10.00 | 10.50 |
| Spelter, spot | 8.35 | 7.90 |
| Tin | 70.50 | 70.00 to 71.00 |
| Aluminum, 98 to 99 per cent | 32.00 to 33.00 | 32.00 to 33.00 |

### OLD METALS

| | Cents per Pound | Cents per Pound |
|---|---|---|
| Heavy copper and wire | 18.00 to 19.00 | 20.50 to 21.00 |
| Brass, heavy | 11.00 to 11.50 | 11.00 to 11.50 |
| Brass, light | 9.00 to 9.50 | 9.50 to 9.75 |
| Lead, heavy | 5.12½ to 5.25 | 5.50 to 5.62½ |
| Zinc, old scrap | 5.00 to 5.50 | 5.25 to 5.50 |

# THE WEEK
## IN TRADE

IN ALMOST every electrical line sales are increasing. The building industry is opening up and again absorbing quantities of material.

Large fuse buying is reported from different sections. Small motors and fixtures also command an active market. Fan sales, on the other hand, were quiet last week. A considerable movement of poles is reported from the Northwest. Appliances are still going well, although washing-machine sales in California appear to be declining. Shortages of weatherproof wire, flexible armored cable and conduit of all kinds are reported.

Wire is reaching a momentary upper level. Conduit is up, as are also certain lines of ranges.

Labor disturbances continue and are particularly severe in certain of the Eastern wire and brass centers.

Collections are probably in a better condition now than they ever were before. Very little slackening of credit is reported.

## NEW YORK

Conditions of the trade are holding well for midsummer business. Sales of straight jobbing materials are in good volume with rigid conduit and accessories showing an increase over past weeks. Prices have advanced on this material, and when the demand picks up more heavily it is expected that further increases will be chalked up. Apparatus is picking up in volume of orders and in size of units. Copper wire has halted momentarily in its upward movement of the past few weeks.

Building throughout the section is increasing. Little is for apartment work. Theater and industrial buildings are on the increase.

Labor is uneasy. Strikes are clearing in some sections and breaking out in others. New York wire centers are having considerable trouble.

**INDUSTRIAL TRUCKS.**—The local market is gradually opening up but is still far from last year's business.

**SAFETY SWITCHES.**—Prices on safety switches and iron-box inclosed switches have advanced 10 per cent. Buying is in better volume and increasing at a fair rate.

**USED APPARATUS.**—More interest is being shown, and there is better ordering of generators, turbines and large-size motors. Business, however, is still below normal.

**FRICTION TAPE.**—Price advances have been spotty. Increases of 5 cents a pound on certain brands have been reported. Some prominent manufacturers, however, have announcd no increase in price, and one of these does not expect to do so during 1919 because of sufficient stocks of raw material. One jobber reported no stocks of tape early this week but expected quick replenishing. Heavy buying last week cleaned him out.

**HARDWARE.**—Factory deliveries on the better quality of wire cutters are much behind and no relief is in sight for several months. Wrenches and hack saws have a good market and deliveries are satisfactory. Prices on all hardware are holding now, but tend upward with a probable rise of about 10 per cent. Many dealers are stocking.

**RIGID CONDUIT.**—Prices advanced 10 per cent last week, and another rise in the near future would not be surprising. The material is moving out of jobbers' houses in better volume.

**TRANSFORMERS.** — The market for distribution-type transformers continues strong and local stocks are being built up in better shape.

**MOLDED INSULATION.**—Orders for the past month have been extremely satisfactory and are continuing in good volume.

**WIRING DEVICES.**—The demand is good and prices, although now steady—in the opinion of one manufacturer—will probably advance to the extent of 5 per cent because of the rising copper and brass and labor market.

**FANS.**—The market is rather quiet and stocks are as a whole much depleted, especially on the larger sizes of direct-current oscillating fans. Some jobbers are still awaiting replacements on these styles.

**WIRE.**—Rubber-covered base still holds at 28 cents, with eight producers quoting, while one is on 29 cents, two on 30 cents and one on cost. Bare wire is quoted on 26 to 28 cents base and weatherproof on 26 to 29 cents.

## CHICAGO

The labor situation is serious in Chicago. More than 100,000 men in the building trade and about 30,000 others were still on strike or locked out last Saturday. Electrical contractors in the Middle West have in most instances more work than they can handle, owing to lack of labor. Utilities have trouble finding contractors to wire old houses. The Commonwealth Edison Company has let contracts for two substations, each to contain three 4000-kva. transformers and space for a spare unit. The Union Power & Light Company of Omaha, Neb., is planning to construct a distribution system at Columbus, Neb. Omaha jobbers report a good demand from flour mills and grain elevators. The Pennsylvania Lines West have resumed work on the five-million-dollar extension from Toledo to Detroit.

Two large hotels, an apartment building containing 1000 apartments and other large buildings are to be erected in Detroit without delay. Three warehouses, a paper-box factory and a candy factory are to be built in St. Paul, Minn., this year at a cost of about $2,000,000. The General Motors Company has awarded a contract for a large factory building in Janesville, Wis. Building projects aggregating over $4,000,000 were announced in Chicago last week.

**WIRE.**—The price again advanced sharply last week. Weatherproof went to a base of 28½ and 29 cents, rubber-covered went up to 29 and 30 cents, while bare wire was around 28 cents. Most of the jobbers have plenty of orders and little stock. Weatherproof is the hardest to find.

**RIGID CONDUIT.**—The price was advanced three points last week. Inquiries continued to come in, but buying in quantities has not started yet.

**FANS.**—Fans rated at 32 volts are in good demand, but there still remain plenty to be sold. There are good stocks of straight fans in Chicago and a fair supply of oscillating types.

**VAPOR-PROOF FITTINGS.**—There is a considerable demand for industrial and office building construction.

**AUTOMOBILE REFLECTORS.** — One manufacturer of automobile spot lights is six weeks behind with deliveries. Plant extensions are being made to overcome this condition.

**STREET LIGHTING.**—Street-lighting prospects are very active, but little business is expected before next month.

**CREDITS AND COLLECTIONS.**—Eliminating the utilities group, the collections of one large jobber are better now than a year ago. Bills are being discounted more promptly, and there is less trouble collecting from those who pay net. On an average collections are between 15 and 20 per cent better now than they were a year ago.

**RANGES.**—The prices of two lines of ranges were increased last week about 20 per cent to 25 per cent. The demand is very heavy, and the manufacturers are behind on their deliveries.

**JUNCTION BOXES.**—Junction boxes for underground cable construction have found a ready sale during the summer months to supply central-station demands where overhead lines are being removed from downtown streets.

**MOTORS.**—There is a steady demand for small series-compensated, single-phase motors. Deliveries can be made from stock on orders for printing-press motors of this type, but motors for other industrial applications are being delivered in from thirty to sixty days.

## BOSTON

The tide of business is rapidly rising, and last week was one of the busiest New England jobbers have had for some time. There is no mistaking the increasing volume of trade, the underlying soundness of business conditions and the resulting optimistic feeling. Building operations are going forward steadily and industrial plants are coming into the electrical market as purchasers of motors, wiring material and miscellaneous supplies. The textile mills are extremely busy and one motor agent reported nineteen propositions on hand last week in this field. Prices hold firm with further upward tendencies in wire, especially for fall delivery. Retail buying is very active. Jobbers' stocks are still well maintained except where undue conservatism prevented early buying from the manufacturers, and barring a few lines like certain washing machines and armored flexible conductor.

An advance of about 5 per cent in iron conduit is reported. Distributers are beginning to realize that deliveries are by no means sure to be maintained at present quotations as the late summer and early fall business accelerates. Factory stocks are being depleted in many lines. The labor situation is easier this week, but last week's traction strike in Rhode Island hit retailers hard and inconvenienced wholesalers not a little.

**MOTORS.**—Orders are coming in rapidly, business being highly diversified. Prices are steady and stocks are good in the main, barring gaps in occasional sizes.

**WIRING MATERIAL.**—A very substantial demand with firm prices is noted.

**ELECTRIC SIGNS.**—Indications point to a splendid fall business. Lamps and material are plentiful now, and every month sees more expansion.

**FANS.**—While trade has been fair since July 1, there is some disappointment being voiced in retail circles because the last torrid spell included a holiday and week-end. The effect of closed stores has hurt subsequent fan orders, in view of the lateness of the season. Stocks are now fairly full, or at least large enough to preclude much more buying from the jobbers this year.

**INTERIOR TELEPHONE EQUIPMENT.**—Business is brisk in the institutional market, hospitals being much in evidence as buyers. A lull in factory orders is noted.

**REFRIGERATING PLANTS.**—Increasing prices of ice and a shortage of this commodity in some localities are booming the sale of electrically driven refrigerating sets. Deliveries are growing longer, and factory stocks are heavily drawn upon. The motor and control end of this business is being nicely handled, however.

**FUSES.**—Sales are in good volume, with steady prices. Stocks appear ample to meet the demands of the next few months. Sales have increased materially since summer began. Competition is keen and further expansion of the building trade is sought to provide an outlet for existing facilities.

**WASHING MACHINES.** — An enormous demand continues, and there is a decided tendency among certain makes toward longer deliveries.

**IRONS.**—The demand is well maintained. Ninety-three irons were sold without a special campaign last week by a single central station serving a rural area in northern New England—an indication of the sustained market which exists for these staple devices.

**WIRE.**—Rubber-covered wire is running close to a 30-cent base. Sales are in excellent volume. Armored flexible conductor is still short.

**COLLECTIONS AND CREDITS.**—Diversified opinions are heard as to collections. Central-station credit holds up solidly, and industrial buyers are not causing the jobber much uneasiness. Some collections, however, are a little longer than the jobber would prefer, and it has taken a long time to settle some of the old government accounts. A cautious policy regarding credits is generally being maintained, but underlying conditions are regarded as sound. The need of more complete accounting among contractors is still a theme for discussion in jobbing circles.

## ATLANTA

Almost all lines are sharing in the present demand and prosperity is pretty well distributed. Contractors are busy and their collections are excellent. The municipal government committee of the House of Representatives of Georgia voted unanimously to kill the municipal ownership bill for Atlanta, presented by Mayor Key and covering the properties of the Georgia Railway & Power Company.

**EXHAUST FANS.**—Jobbers' and dealers' stocks have been pretty well cleaned up. Small ventilating outfits up to 16 in. are going well. Manufacturers have kept their stocks in good condition and no shortages are evidenced.

**WIRE.**—Prices continue to soar. Rubber-covered base has touched 28 cents base, and weatherproof 26½ cents. Shortages are reported in several sizes of weatherproof, and promises of shipments and deliveries are uncertain. Rubber-covered shipments are growing longer. Large orders for wire of all descriptions are coming in.

**PANELBOARDS.**—A big business is recorded, with shipments on standard material promised for three weeks.

**STAMPED-STEEL BOXES.**—These are moving freely; in fact, a substantial gain in volume of transactions is observed over the previous two weeks. Local stocks are in fair condition considering the drain of the recent demand.

**ARMORED STEEL CABLE.**—A serious shortage is noted in the Southeast. One fortunate jobber has a fair stock and is picking up profitable orders thereby. In the anticipation of still higher prices a heavy buying movement has taken place. The total volume of sales is beginning to assume large proportions.

**METAL MOLDING.**—Manufacturers report marked and insistent calls, which are being filled promptly from existing stocks. Factory shipments are fair and tend to grow longer. Prices are firm.

**HOISTS.**—Industrials and shipbuilding plants are making numerous inquiries, but little business is being transacted. Shipments have improved.

**MOTORS.**—There is a heavy demand for 75-hp. to 200-hp. sizes. Factory stocks are short on these sizes and shipment promises are longer. The market for sizes up to 50 hp. is quite active, and very good deliveries are made from local stocks.

**CONDUIT.**—Rigid conduit advanced about 4 per cent July 24. Buyers appear to be entering the market from every direction and the black and white product is moving briskly. Factory shipments are getting longer, being promised for four weeks. Southeastern stocks are very low and estimated to be 30 per cent of normal.

**NON-METALLIC CONDUIT.**—The heavy requirements for building operations in the Southeast have depleted many stocks. Factory shipments are poor. Prices advanced another 10 per cent this week.

**FANS.**—With the exception of the last two days of this week, the fan turnover has been excellent. Manufacturers state that their stocks are cleaned out and certain jobbers have everything they can secure. There are practically no fans at Atlanta, with the possible exception of small direct-current lots. Reorders have been put through for ceiling and desk types, but it is not expected that deliveries will be soon enough to fill the current demand.

**FLEXIBLE STEEL CONDUIT.**—After a long dormant period, activity has quickened within the week, and depleted local stocks are the result. But factory shipments are good and stocks will be replenished shortly. Jobbers are expecting a change upward in price soon and quite a number are arranging to build up their stocks.

## SEATTLE—PORTLAND

During the past week wholesale and retail trade has been pretty good, although no sales of any unusually large nature were reported. Industry is active under lower pressure than during the war period and is expanding along some lines. At all Puget Sound ports there has been marked increase in imports and decrease in exports.

There is practically no change in shipbuilding. Seattle and Portland yards, building steel ships, are working steadily, though at slightly reduced speed, and have enough contracts to keep running for the rest of the year at least. Sale of six wooden ships belonging to the Emergency Fleet Corporation and now lying idle in Seattle, and an application for an option on twelve others, will mean expenditure of hundreds of thousands of dollars in completing and equipping the ships.

In Seattle collections are keeping pace with sales. During the month of July very few new credits were placed, business transacted being merely extension of credit to old customers. Anticipation of substantial returns from agricultural products is stimulating freer buying for fall and winter deliveries.

Some of the eastern Washington towns report a sensational improvement in wholesale and retail trade, with activity exceeding that of the pre-war period. Portland jobbers report about the usual run of business during the past week. The unusually hot weather of the past two weeks created a very active trade in electric fans, which later slowed down. Continued activity in household appliances and the upward tendency in the price of copper are the two outstanding features of the week. Collections in Portland, and in fact throughout Oregon, are reported good. During the week three Portland manufacturing concerns announced the intention of installing electrically operated equipment.

**MOTORS.**—There is an increasing demand, particularly for smaller sizes for use in vegetable and fruit canning plants. During the past week several orders of considerable moment were placed for motors for shingle mills. Larger sizes are not moving to any extent.

**FIXTURES.**—The volume of sales, which has been heavy for several months, is still growing in Seattle. The sales of direct and semi-direct types, are claimed by retailers to be unprecedented. Sales to rural communities are well sustained. Shipments are coming through fairly well, yet stocks are hard to maintain.

**POLES.**—A movement of considerable importance was noted last week for maintenance on rural lines and for one extension of importance. Prices recently advanced slightly.

## SAN FRANCISCO

Because of the absence of most of the jobbers' salesmen upon their vacations the electrical business temporarily is rather quiet, as is also the case with the counter and retail business. The telephone strike has been settled on a compromise basis and there is no present sign of any further spread of the shipyard strike. While no important building has been announced this past week, there have been many contracts of $100,000 or more let for apartment houses.

**RANGES.**—Dealers and central-station men were considerably disconcerted by the announcement of a 25 per cent advance in the list price of ranges, ovens and water heaters. Several campaigns are on foot, and to many "prospects" quotations on the old basis had been made.

**SEWING MACHINES.**—There has been a slight slump in jobbers' sales because dealers are well stocked. About six carloads of portable electric machines have been sold on the Pacific Coast this year.

**DISHWASHERS.**—Dealers report many sales in towns in the hot valley belt for soda fountain use.

**WASHING MACHINES.**—Washing-machine sales are only about 50 per cent what they ran a month or so ago but dealers are still filling back orders on the strength of better factory shipments.

**CONDUIT.**—Sales are brisk principally to state and municipal installations. Stocks are good but they will be needed very soon when the increasing building reaches the electrical stage.

**SCHEDULE MATERIAL.**—Sockets and switches, etc., have slowed down during the summer. Inclosed fuses are more in demand just now than refillable types, of which large stocks are tied up with jobbers.

# Current Prices of Electrical Supplies

## *New York and Chicago Quotations*

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit.

Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

### Armored Conductor, Flexible Steel

*Single-Conductor*

| B. & S. Size | List per 1000 Ft. |
|---|---|
| No. 14 solid | $61.00 |
| No. 12 solid | 71.00 |
| No. 10 solid | 90.00 |
| No. 8 solid | 106.00 |
| No. 6 solid | 145.00 |
| No. 10 stranded | 95.00 |
| No. 8 stranded | 115.00 |
| No. 6 stranded | 160.00 |
| No. 4 stranded | 205.00 |
| No. 2 stranded | 266.00 |
| No. 1 stranded | 315.00 |

*Twin-Conductor*

| | |
|---|---|
| No. 14 solid | 104.00 |
| No. 12 solid | 135.00 |
| No. 10 solid | 185.00 |
| No. 8 stranded | 235.00 |
| No. 6 stranded | 370.00 |
| No. 4 stranded | 575.00 |

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

*Single-Conductor*

| | |
|---|---|
| No. 14 Solid | |
| Less than coil | +10% to 20% |
| Coil to 1000 ft | List to 25% |
| No. 12 Solid | |
| Less than coil | +10% to 20% |
| Coil to 1000 ft | List to 25% |

*Twin-Conductor*

| | |
|---|---|
| No. 14 Solid | |
| Less than coil | +10% to 20% |
| Coil to 1000 ft | List to 25% |
| No. 12 Solid | |
| Less than coil | +10% to 20% |
| Coil to 1000 ft | List to 25% |

DISCOUNT—CHICAGO

*Single-Conductor*

| | |
|---|---|
| No. 14 Solid | |
| Less than coil | List |
| Coil to 1000 ft | 5% |
| No. 12 Solid | |
| Less than coil | List |
| Coil to 1000 ft | 5% |

*Twin-Conductor*

| | |
|---|---|
| No. 14 Solid | |
| Less than coil | $100.00 |
| Coil to 1000 ft | 82.50 |
| No. 12 Solid | |
| Less than coil | List |
| Coil to 1000 ft | 5% |

### Attachment Plugs

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg | +20% |
| 1/5 to std. pkg | List |
| Std. pkg | 15% |

DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg | +20% to list |
| 1/5 to std. pkg | List to 20% |
| Std. pkg | 23% to 36% |

### Batteries, Dry

NEW YORK

| Each Net | No. 6 Regular | No. 6 Ignitor |
|---|---|---|
| Less than 12 | $0.45 | $0.45 |
| 12 to 50 | .40 | .40 |
| 50 to barrel | .36 | .37 |
| Barrel lots | .329 | .339 |

### Batteries, Dry—*Continued*

CHICAGO

| Each Net | No. 6 Regular | No. 6 Ignitor |
|---|---|---|
| Less than 12 | $0.45 | $0.45 |
| 12 to 50 | .38 | .38 to $0.39 |
| 50 to barrel | .362 | .372 |
| Barrel lots | .332 | .342 |

### Conduit, Metallic Flexible

| Size, In. | Ft. per Coil | List per 100 Ft. |
|---|---|---|
| ⅛ | 250 | $5.00 |
| ¼ | 250 | 7.50 |
| ⅜ | 100 | 10.00 |
| ½ | 50 | 13.00 |
| 1 | 50 | 21.00 |
| 1¼ | 50 | 26.00 |
| 1½ | 25–50 | 35.00 |
| 2 | 25–50 | 45.00 |
| 2½ | 25–50 | 52.00 |

NET PER 1000 FT.—NEW YORK

| | Less than Coil | Coil to 1000 Ft. |
|---|---|---|
| ⅜-in. single trip | $75.00 | $63.75— 69.75 |
| ⅜-in. double strip | 75.00— 82.50 | 72.00— 75.00 |
| ½-in. single strip | 100.00 | 85.00— 93.00 |
| ½-in. double strip | 100.00—110.00 | 96.00—100.00 |

NET PER 1000 FT.—CHICAGO

| | Less than Coil | Coil to 1000 Ft. |
|---|---|---|
| ⅜-in. single strip | $75.00 | $63.25 to $63.75 |
| ⅜-in. double strip | 78.25 | 71.25 |
| ½-in. single strip | 100.00 | 75.00 to 85.00 |
| ½-in. double strip | 105.00 to 109.00 | 93.00 to 95.00 |

### Conduit, Non-Metallic Flexible

| Size, In. | List per Foot | Size, In. | List per Foot |
|---|---|---|---|
| ⅛ | $0.05½ | 1 | $0.25 |
| ¼ | .06 | 1¼ | .33 |
| ⅜ | .09 | 1½ | .40 |
| ½ | .12 | 1¾ | .47 |
| ⅝ | .15 | 2 | .55 |
| ¾ | .18 | 2½ | .65 |

NET PER 1000 FT.—NEW YORK

| | Less than $15 List | $15 to $60 List | $60 to $150 List |
|---|---|---|---|
| ⅛-in.— | $30.00 | $22.00 | $21.00 |
| ¼-in.— | 35.00 | 24.00 | 23.00 |

NET PER 1000 FT.—CHICAGO

| | Less than 250 ft. | 250 to 2500 ft. | 2500 to 10,000 ft. |
|---|---|---|---|
| ⅛-in.— | $33.00–$42.00 | $17.50–21.00 | $16.25–19.00 |
| ¼-in.— | 36.00– 45.00 | 19.00–22.75 | 17.75–21.25 |

### Conduit, Couplings and Elbows, Rigid Iron

*Card No.* 40

| Size, In. | Conduit, List per Foot |
|---|---|
| ⅛ | $0.08½ |
| ¼ | .08½ |
| ⅜ | .08½ |
| ½ | .11½ |
| 1 | .17 |
| 1¼ | .23 |
| 1½ | .27½ |
| 2 | .37½ |
| 2½ | .58½ |
| 3 | .76½ |

### Conduit, Couplings and Elbows, Rigid Iron—*Continued*

| Size, In. | Couplings, List | Elbows, List |
|---|---|---|
| ⅛ | $0.05 | $0.19 |
| ¼ | .06 | .19 |
| ⅜ | .07 | .19 |
| ½ | .10 | .25 |
| 1 | .13 | .37 |
| 1¼ | .17 | .45 |
| 1½ | .21 | .50 |
| 2 | .28 | 1.10 |
| 2½ | .40 | 1.80 |
| 3 | .60 | 4.80 |

DISCOUNT—NEW YORK

| | ⅛ in. to ½ in. | ¾ in. to 3 in. |
|---|---|---|
| Less than 2500 lb. | 4% to 12.1% | 6% to 14.1% |
| 2500 to 5000 lb. | 9% to 15.1% | 11% to 17.1% |

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

| | ⅛ to ½ In. | ¾ to 3 In. |
|---|---|---|
| Less than 2500 lb. | +3% to 6.1% | 2% to 8.1% |
| 2500 to 5000 lb. | +1% to 11.1% | 4% to 13.1% |

(For galvanized deduct six points from above discounts.)

### Flatirons

NEW YORK

| | |
|---|---|
| List price | $6.50 to $7.50 |
| Discount | 25% |

CHICAGO

| | |
|---|---|
| List price | $6.50 to $7.50 |
| Discount | 25% to 30% |

### Fuses, Inclosed

| 250-Volt | Std. Pkg. | List |
|---|---|---|
| 3-amp. to 30-amp. | 100 | $0.25 |
| 35-amp. to 60-amp. | 100 | .35 |
| 65-amp. to 100-amp. | 50 | .90 |
| 110-amp. to 200-amp. | 25 | 2.00 |
| 225-amp. to 400-amp. | 25 | 3.60 |
| 450-amp. to 600-amp. | 10 | 5.50 |
| 600-Volt | | |
| 3-amp. to 30-amp. | 100 | $0.40 |
| 35-amp. to 60-amp. | 100 | .60 |
| 65-amp. to 100-amp. | 50 | 1.50 |
| 110-amp. to 200-amp. | 25 | 2.50 |
| 225-amp. to 400-amp. | 25 | 5.50 |
| 450-amp. to 600-amp. | 10 | 8.00 |

DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg | 30% |
| 1/5 to std. pkg | 40% |

DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg | 30% |
| 1/5 to std. pkg | 40% |

### Fuse Plugs

*3-Amp. to 30-Amp.*

NEW YORK

| | Per 100 Net |
|---|---|
| Less than 1/5 std. pkg | $6.00 to $8.75 |
| 1/5 to std. pkg | 5.50 to 7.00 |

Standard packages, 500. List, each, $0.07

CHICAGO

| | Per 100 Net |
|---|---|
| Less than 1/5 std. pkg | $8.00 |
| 1/5 to std. pkg | 7.00 |

Standard packages, 500. List each, $0.07

## Lamps, Mazda or Tungsten

*110 to 125 Volts*

| Regular, Clear: | Std. Pkg. | List Each |
|---|---|---|
| 10 to 40-watt—B | 100 | $0.35 |
| 60-watt—B | 100 | .40 |
| 100-watt—B | 24 | .85 |
| 75-watt—C | 50 | .70 |
| 100-watt—C | 24 | 1.10 |
| 200-watt—C | 24 | 2.20 |
| 300-watt—C | 24 | 3.25 |
| Round Bulbs, 3½-in., Frosted | | |
| 15-watt—G 25 | 50 | .60 |
| 25-watt—G 25 | 50 | .60 |
| 40-watt—G 25 | 50 | .60 |
| Round Bulbs, 3½-in., Frosted: | | |
| 60-watt—G 30 | 24 | .82 |
| Round Bulbs, 4½-in., Frosted: | | |
| 100-watt—G 35 | 24 | 1.15 |

DISCOUNT—NEW YORK

| | |
|---|---|
| Less than std. pkg. | List |
| Std. pkg. | 10% |

DISCOUNT—CHICAGO

| | |
|---|---|
| Less than std. pkg. | List |
| Std. pkg. | 10% |

## Lamp Cord

*Cotton-Covered, Type C, No. 18*

NEW YORK

| | Per 1000 Ft. Net |
|---|---|
| Less than coil (250 ft.) | $28.06–$35.01 |
| Coil to 1000 ft. | 25.26– 29.17 |

CHICAGO

| | Per 1000 Ft. Net |
|---|---|
| Less than coil (250 ft.) | $21.00–$32.00 |
| Coil to 1000 | 21.00– 23.00 |

## Lamp Guards, Wire

Standard packages from 50 to 150

NEW YORK

| | |
|---|---|
| Net per 100 | $29.70 to $33.00 |

CHICAGO

| | |
|---|---|
| Net per 100 | $29.70 to $33.00 |

## Outlet Boxes

| Nos. | List per 100 |
|---|---|
| 101—A, A 1½, 4 S.C., 6200, 320 | $30.00 |
| 102—B.A., 6200, S.E., 300, A.X., 1½, 4 S. | 30.00 |
| 103—C.A., 9, 4R, B 1½ | 25.00 |
| 106—F.A., 7, C.S., 1½, 3 R | 20.00 |

DISCOUNT—NEW YORK

| | Black | Galvanized |
|---|---|---|
| Less than $10.00 list | 26%–38% | 20%–33% |
| $10.00 to $50.00 list | 36%–47% | 31%–43% |

DISCOUNT—CHICAGO

| | Black | Galvanized |
|---|---|---|
| Less than $10.00 list | 33%–40% | 24%–32% |
| $10.00 to $50.00 list | 45%–50% | 32%–43% |

## Pipe Fittings

DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg. | 10% |
| 1/5 to std. pkg. | 20% |
| Std. pkg. | 30% |

DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg. | 10% |
| 1/5 to std. pkg. | 20% |
| Std. pkg. | 30% |

## Porcelain Cleats—Unglazed

*Two and Three Wire*

NEW YORK

| | Per 1000 Net |
|---|---|
| Less than 1/5 std. pkg. | $15.00 to $22.40 |
| 1/5 to std. pkg. | 12.00 to 15.35 |
| Standard package, 2200. List per 1000, | $21 to $34 |

CHICAGO

| | Per 1000 Net |
|---|---|
| Less than 1/5 std. pkg. | $17.85–$24.15 |
| 1/5 to std. pkg. | 14.70– 21.00 |
| Standard pkg., 2200. List per 1000, | $20.00 to 21.00 |

## Porcelain Knobs

NEW YORK

| Per 1000 Net. | Std. Pkg. 3500. | Std. Pkg. 4000 |
|---|---|---|
| | 5½ N.C.—Solid Nail-it—N.C. | |
| Less than 1/5 std. pkg | $13.60–$15.00 | $22.00–$22.40 |
| 1/5 to std. pkg. | 10.50– 11.20 | 15.35– 18.00 |

CHICAGO

| Per 1000 Net. | Std. Pkg. 3500. | Std. Pkg. 4000 |
|---|---|---|
| | 5½ N.C.—Solid Nail-it—N.C. | |
| Less than 1/5 std. pkg. | $13.60–$18.40 | $27.20–$36.80 |
| 1/5 to std. pkg. | 11.20– 16.00 | 22.40– 32.00 |

## Sockets and Receptacles

| | Std. Pkg. | List |
|---|---|---|
| ½-in. cap key and push sockets | 500 | $0.33 |
| ½-in. cap keyless socket | 500 | .30 |
| ½-in. cap pull socket | 250 | .60 |

DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg. | +20% |
| 1/5 to std. pkg. | List |

DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg. | +20 to list |
| 1/5 std. pkg. | List to 10% |

## Switches, Knife

*250-Volt, Front Connections, No Fuse*

| | |
|---|---|
| High Grade: | |
| 30-amp. S. P. S. T. | $0.80 |
| 60-amp. S. P. S. T. | 1.20 |
| 100-amp. S. P. S. T. | 2.25 |
| 200-amp. S. P. S. T. | 3.48 |
| 300-amp. S. P. S. T. | 5.34 |
| 30-amp. D. P. S. T. | 1.20 |
| 60-amp. D. P. S. T. | 1.78 |
| 100-amp. D. P. S. T. | 3.38 |
| 200-amp. D. P. S. T. | 5.20 |
| 300-amp. D. P. S. T. | 8.00 |
| 30-amp. 3 P. S. T. | 1.80 |
| 60-amp. 3 P. S. T. | 2.68 |
| 100-amp. 3 P. S. T. | 5.08 |
| 200-amp. 3 P. S. T. | 7.80 |
| 300-amp. 3 P. S. T. | 12.00 |
| Low Grade: | |
| 30-amp. S. P. S. T. | $0.42 |
| 60-amp. S. P. S. T. | .74 |
| 100-amp. S. P. S. T. | 1.50 |
| 200-amp. S. P. S. T. | 2.70 |
| 30-amp. D. P. S. T. | .68 |
| 60-amp. D. P. S. T. | 1.22 |
| 100-amp. D. P. S. T. | 2.50 |
| 200-amp. D. P. S. T. | 4.50 |
| 30-amp. 3 P. S. T. | 1.02 |
| 60-amp. 3 P. S. T. | 1.84 |
| 100-amp. 3 P. S. T. | 3.76 |
| 200-amp. 3 P. S. T. | 6.76 |

DISCOUNT—NEW YORK

| | High Grade |
|---|---|
| Less than $10 list | +15% |
| $10 to $25 list | 2% |
| $25 to $50 list | 5% |
| | Low Grade |
| Less than $10 list | +5% |
| $10 to $25 list | 8% |
| $25 to $50 list | 15% |

DISCOUNT—CHICAGO

| | High Grade |
|---|---|
| Less than $10 list | +25% |
| $10 to $25 list | +10% |
| $25 to $50 list | +5% |
| | Low Grade |
| Less than $10 list | +15% |
| $10 to $25 list | 2% |
| $25 to $50 list | 5% |

## Switches, Snap and Flush

*5-Amp. and 10-Amp., 125-Volt Snap Switches*

| | Std. Pkg. | List |
|---|---|---|
| 5-amp. single-pole | 250 | $0.28 |
| 5-amp. single-pole, ind | 250 | .32 |
| 10-amp. single-pole | 100 | .48 |
| 10-amp. single-pole, ind | 100 | .54 |
| 5-amp. three-point | 100 | .54 |
| 10-amp. three-point | 50 | .76 |
| 10-amp., 250-volt, D. P. | 100 | .66 |

*10-Amp., 250-Volt Push-Button Switches*

| | Std. Pkg. | List |
|---|---|---|
| 10-amp. single-pole | 100 | $0.45 |
| 10-amp. three-way | 50 | .70 |
| 10-amp. double-pole | 50 | .70 |

## Switches, Snap and Flush—*Continued*

DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg. | +20% |
| 1/5 to std. pkg. | List |
| Std. pkg. | 15% to 17% |

DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg. | +20% |
| 1/5 to std. pkg. | List |
| Std. pkg. | 23% |

## Switch Boxes, Sectional Conduit

| Union and Similar— | List Each |
|---|---|
| No. 155 | $0.34 |
| No. 160 | .60 |

DISCOUNT—NEW YORK

| | Black | Galvanized |
|---|---|---|
| Less than $2.00 list | 18%–20% | List–18% |
| $2.00 to $10.00 list | 28%–30% | 5%–28% |
| $10.00 to $50.00 list | 45%–50% | 10%–47% |

DISCOUNT—CHICAGO

| | Galvanized | Black |
|---|---|---|
| Less than $2.00 list | 30% to 33% | 24% to 25% |
| $2.00 to $10.00 list | 30% to 33% | 24% to 25% |
| $10.00 to $50.00 list | 30% to 45% | 25% to 36% |

## Toasters, Upright

NEW YORK

| | |
|---|---|
| List price | $6.00 to $7.00 |
| Discount | 25% |

CHICAGO

| | |
|---|---|
| List price | $7.00 |
| Discount | 25% to 30% |

## Wire, Annunciator

NEW YORK

| | Per Lb. Net |
|---|---|
| No. 18, less than full spools | $0.49 |
| No. 18, full spools | .48 |

CHICAGO

| | Per Lb. Net |
|---|---|
| No. 18, less than full spools | $0.50 to $0.54 |
| No. 18, full spools | .445 to .48 |

## Wire, Rubber-Covered, N. C.

*Solid-Conductor, Single-Braid*

NEW YORK

| | Price per 1000 Ft. Net | | |
|---|---|---|---|
| No. | Less than 500 Ft. | 500 to 1000 Ft. | 1000 to 5000 Ft. |
| 14 | $14.00 | $11.50 | $10.00 |
| 12 | 20.34 | 20.34 | 15.25 |
| 10 | 27.72 | 27.72 | 18.48 |
| 8 | 38.52 | 32.10 | 25.68 |
| 6 | 61.02 | 45.78 | 40.68 |

CHICAGO

| | Price per 1000 Ft. Net | | |
|---|---|---|---|
| No. | Less than 500 Ft. | 500 to 2500 Ft. | 2500 to 5000 Ft. |
| 14 | $21.00 | $11.50 | $11.50 |
| 12 | 26.00 | 17.00 | 17.00 |
| 10 | 32.90 | 32.90 | 28.50 |
| 8 | 45.64 | 39.12 | 39.12 |
| 6 | 72.45 | 62.10 | 62.10 |

## Wire, Weatherproof

*Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.*

NEW YORK

| | Per 100 Lb. Net |
|---|---|
| Less than 25 lb. | $31.00 |
| 25 to 50 lb. | 31.00 |
| 50 to 100 lb. | 30.00 |

CHICAGO

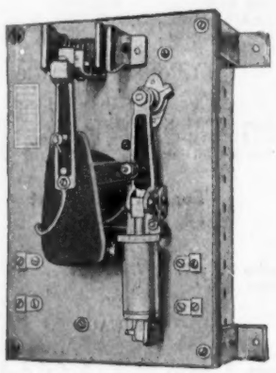
| | Per 100 Lb. Net |
|---|---|
| Less than 25 lb. | $30.75 |
| 25 to 50 lb. | 30.75 |
| 50 to 100 lb. | 30.75 |

# NEW APPARATUS & APPLIANCES

## A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

### Automatic Starter for Small D. C. Motors

The line contactor and the accelerating mechanism are both pulled in by one magnet coil in the push-button-operated automatic starter for small



CONTACTOR AND ACCELERATING MECHANISM PULLED IN BY ONE COIL

direct-current motors recently developed by the Rowan Controller Company, 308 North Holliday Street, Baltimore, Md. When the contactor closes by the starting button being pressed a spring is compressed and, by expanding against the retarding effect of a dashpot, it closes the contact for cutting out the starting resistance.

This starter is more simple and compact than older types made by this company. It is built in sizes for motors up to and including 5 hp.

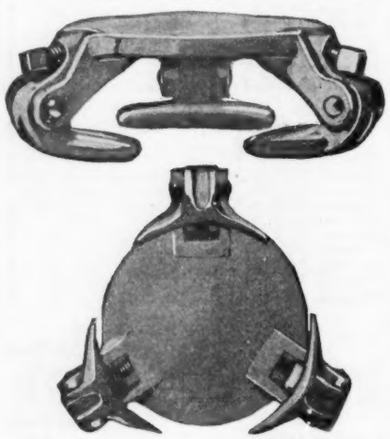
### Cap for Mounting on Line Insulators

An insulator cap which, according to the makers, may be safely used on all insulators subjected to great torsional loadings, on all switchwork and for the mounting of line hardware has been recently developed by Hickey & Schneider, Inc., of Elizabeth, N. J. It is known as type 326 and is made in sizes to fit standard types of insulators.

As may be seen in the accompanying illustration, three pairs of ears between which three clamp legs are pivotally mounted extend from the top disk. The lower parts of the legs are each shaped into two fingers, which securely grip the insulator head around the tie wire groove. The upper section is threaded for a steel set screw, and the clamp fingers are brought in contact with the insulator head by tightening the set screw against a cam-shaped surface in the top disk. Through the lower action of the set screw and the upper part of the clamp leg an enormous pressure can be exerted by the clamp fingers. To prevent fracture of the porcelain surface, fiber or copper cushions are used between the metal of the cap and the porcelain.

Each clamp leg can be adjusted separately so that a sure grip may be obtained even on slightly oval or irregularly shaped insulator heads. Furthermore, this independent adjustment of the three clamp legs makes possible the centering of the top disk without difficulty. The insulator may be centered in the cap after the latter has been bolted against the mounting surface. The top disk is raised sufficiently above the head of the insulator to provide clearance for the head of a standard ½-in. (1.3-cm.) bolt.

The insulator caps are made of malleable iron, hot-dip galvanized, or of



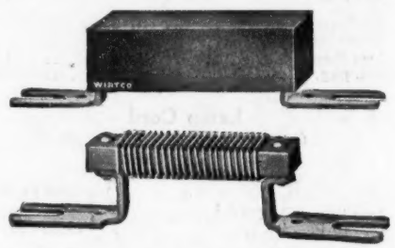
SIDE AND BOTTOM ELEVATIONS OF CAP FOR 35,000-VOLT LINE INSULATOR

bronze. The pivots and the set screws are of sherardized-finish steel. The top disk is customarily furnished without drilling.

### Steel-Inclosed Resistance Unit for Heavy Work

For starting duty, or other work where heavy temporary overload must be provided for, the No. 42 "Di-el-ite" resistance unit has been recently developed by the Wirt Company of Philadelphia. It will radiate six or more watts a square inch (6.4 sq. cm.) in continuous service when exposed to free air circulation, although this rate of work gives a higher temperature than most engineers care to specify for commercial work, and the maker recommends 3 watts a square inch (6.4 sq. cm.) of radiating surface.

The unit is iron-clad, having a steel case which makes it particularly suitable for hard work or rough handling. The terminals provide support and can



FOR WORK WHERE HEAVY TEMPORARY OVERLOAD MUST BE PROVIDED FOR

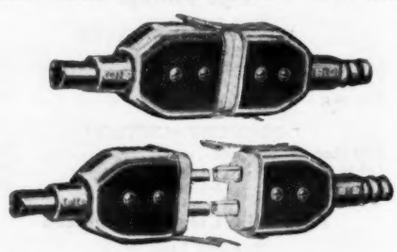
be made to fit standard fuse blocks. The "Di-el-ite" filling is of ample thickness to give good electrical and mechanical protection to the resistance wire.

The unit can also be obtained with pigtail terminals for installations where the rigid style are not adaptable.

### Electrical Coupler

Double, single and triple-pole style "Keystone" type L-2 couplers for providing a detachable electrical connection have recently been placed on the market by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, and 50 Church Street, New York City. All types are furnished with connections properly mounted within impregnated maple blocks, which in turn are mounted within cast-metal covers.

The couplers are equipped complete, as illustrated, but without the conduit and flexible conduit shown in either



CONNECTIONS MOUNTED IN IMPREGNATED MAPLE BLOCKS

end. The current capacity of the couplers is 15 amp. They are supplied with 12-in. (30-cm.) insulated flexible wire leads and are 8½ in. (21.5 cm.) in length.

## Electric Headlights for Industrial Locomotive

The industrial locomotive headlights, type MLC-96, recently brought out by the Electric Service Supplies Company, Cambria and Seventeenth Streets, Philadelphia, and 50 Church Street, New York City, are for use on industrial locomotives where rough temporary track work must be encountered and also where an intensive beam of light is not desirable.

The cases are made entirely of cast iron, including the door, which is cast

REFLECTOR AND SOCKER FLEXIBLY SUSPENDED TO PREVENT BREAKAGE

with a grid. Both front and rear doors are fitted with gaskets and latches. The 9-in. (228-mm.) "Golden Glow" reflector and the socket are flexibly suspended in the case in order to prevent the vibration of the locomotive from breaking the lamp filament. This is accomplished by mounting the entire meechanism in a shell in which the parts are hung by springs. This shell may be removed through the front door.

The headlights are supplied with a type S focusing device, which provides for adjustment of the lamp inwardly or outwardly until properly focused.

The general dimensions of the headlights are: maximum diameter of the body, 11 $\frac{3}{16}$ in. (284 mm.); height over all, 11 $\frac{11}{16}$ in (296 mm.); length over all, 9½ in. (241 mm.); width over all, 13¼ in. (336 mm.), and weight, approximately 25 lb. (11 kg.).

## Home-Size Storage-Battery Charger

To meet the requirements of home storage-battery charging the France Manufacturing Company, West 104th

CHARGER IS PORTABLE, AUTOMATIC AND CANNOT OVERCHARGE BATTERY

Street and Berea Road. Cleveland. Ohio, has brought out the portable F-F "Bantam battery booster," which is constructed the same as its standard rectifier but is smaller and has a charging rate of 8 amp. It is made in one style, known as type 6, and operates from a lamp socket on 100 to 130-volt, 60-cycle alternating current. The "booster" will fully charge a 6-volt battery of any ampere-hour capacity, and it can be used on a 12-volt battery by charging three cells at a time.

The device is self-starting and unaffected by line failures—if current is turned off, battery cannot discharge through the rectifier—and a powerful permanent magnet acts positively as a magnetic circuit breaker to open the charging circuit. When current is turned on the rectifier starts itself, thus charging may be carried on safely over night without attention.

A special unidirectional current ammeter shows plainly how the charger is working and what current is flowing into the battery. The equipment also includes a long extension cord and plug and heavy charging wires with red positive wire and battery clips. The finish of the charger is black enamel, its dimensions are 5 in. by 7 in. by 7 in. (12.7 cm. by 17.7 cm. by 17.7 cm.), and its shipping weight is 10 lb. (4.5 kg.).

## Electrical Muscle-Testing Apparatus

The muscle-testing condenser apparatus manufactured by the Wappler Electric Company of 173 East Eighty-

COMPACT AND TRANSPORTABLE

seventh Street, New York City, and illustrated herewith was developed for particular use in the United States Army's reconstruction hospitals by the maker in conjunction with the Surgeon-General's office. It operates on 110-volt direct current and consists of a progressive series of condensers in 399 steps of 0.01 microfarads each. This series of dry condensers is equipped with switches so that any desired capacity between 0.01 and 3.99 microfarads can be obtained. A voltmeter and a voltage-controlled rheostat are provided so that the condensers may be charged at a uniform voltage. In order to cause a discharge through the muscle to which the electrodes of the apparatus are applied, a discharge switch is employed and a pole-changer is furnished so that the polarity of the impulse can be reversed.

With the apparatus are provided an inlet cable, two cords, an asbestos sponge electrode, a nerve-testing electrode and two electrode handles. For use where the direct current necessary to operate the muscle-testing apparatus is not available but alternating current is, a small motor-generator producing 110-volt direct current can be obtained. Both the muscle-testing apparatus and the motor-generator are mounted in substantial wooden cases, making them readily transportable.

## Electric Buffing and Grinding Machines

Combined electric buffing and grinding machines with 2-hp. and 3-hp. single-phase motors and 2-hp., 3-hp. and 5-hp. three-phase motors for 110, 220 and 440-volt operation are being offered to the trade by the LeBron Electric Works of Omaha, Neb. The motor and the buffing and grinding wheels are mounted on a pedestal which places the center of the shaft about 36 in. (91 cm.) above the floor.

## Standard-Dome Reflectors

Recent additions to the industrial lighting equipment manufactured by the Adams-Bagnall Electric Company of Cleveland, Ohio, are porcelain-enameled steel R.L.M. standard-dome reflectors. They are furnished in sizes to use tungsten lamps of 75, 100-150, 200, 300, 400-500 and 750-1000 watts. The diameters of the reflectors range from 12 in. to 20 in. (30 cm. to 50 cm.).

Ordinarily, these reflectors are furnished with universal holder sockets which combine a metal reflector support and a lamp socket and can be interchangeably used on dome, bowl and angle "Abolites" of various sizes. The reflectors are also furnished with standard 3½-in. (8-cm.) shade holders, which will also fit any of the other reflectors. In addition, they can be supplied in the heel type for use with the standard 1¼-in. (5.7-cm.) shade holder carried in all jobbers' stocks.

The holder socket type of these reflectors is furnished in both two-piece and one-piece types. With the two-piece type the reflector is readily at-

18-IN. REFLECTOR FITTED WITH STANDARD HOLDER SOCKET

tached to the holder socket and held firmly in proper position by a copper-clad steel spring. In the one-piece unit the holder socket and the reflector are rigidly united by electric welding. The

two-piece type has the largest application on account of its flexibility and also because the reflector unit can be easily taken down and thoroughly cleansed. This ease in washing is of especial value in industries where dirt is very prevalent, as, for example, in railway roundhouses. The one-piece unit is adapted for installation where there is a great deal of vibration or outdoors where wind pressure must be met.

## Electric Heater for Gasoline Distillation

For determining boiling and end points of gasoline, petroleum oils and paint thinners the Central Scientific Company of 460 East Ohio Street, Chicago, has recently designed an electric heater, Bureau of Mines type, to be used for the distillation of gasoline and other volatile fluids.

The construction of the heater is interesting. The spiral heating coil of "Nichrome" wire is inserted in a conical spiral groove turned in a solid block of insulating material. The separate turns of the wire are in contact with the insulating block at only a small part of their circumference, and as a result practically no heat is wasted by absorption in the block.

The conical shape of the depression in the block combined with the high heat-radiating qualities of the material used causes practically all of the heat to be focused upon the 1¼-in. (31.8-mm.) opening in the transite top of the heater. The flask containing the liquid is consequently subjected to an intense heat (sufficient to ignite paper instantly) without danger of breakage due to contact with a bare flame or a red-hot coil. The heating element, consisting of the wire coil together with the grooved block in which it is inserted, can be easily replaced in case of a burn-out.

PRACTICALLY ALL OF HEAT IS FOCUSED ON TRANSITE-TOP OPENING

A variable rheostat is mounted in the same case with the heating coil, permitting the temperature to be raised or lowered at will. The heater is supplied with a clamp which permits it to be mounted on any laboratory support stand. Additional uses for the heater are many, it is pointed out, since it furnishes a rapid and efficient source of concentrated heat which will be found preferable to a gas flame for many operations.

## Three-Phase Alternating-Current Welding Outfits

Three-phase current is used almost universally in factory and rural districts for power purposes, the E. J. Wiggins Electrical Corporation of 722 Main Street, Buffalo, N. Y., points out, and therefore no difficulty is encountered in getting power to operate its three-phase alternating-current welding outfits which handle such current just as the power companies deliver it. Connections are provided in the welder for either 220-volt or 440-volt lines.

The energy is carried through three small wires to the welding outfit, cutting down the copper-wire expense; the voltage is then reduced for the proper welding requirements, and two wires are brought out from the front on the secondary side of the welding outfit, one to be connected to or laid upon the metal which is to be welded, the other wire connected to the electrode holder of carbon or metal, which is held in the hand of the operator. The current passes, or arcs, from the metal which is to be welded to the electrode which is held by the operator. In so doing it creates such great heat on the metal to be welded that a portion of the metal in close proximity to the arc is continuously passing through the vapor thus created.

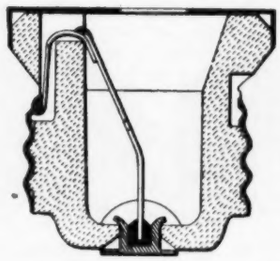
It is important to note, according to the maker, that the welder actually applies to the weld 93 per cent of the current which is drawn from the power line.

Means are provided on the outfit for readily regulating the amount of current at the arc which is essential for and grades of metals. No pre-heating successfully welding various thicknesses is required, consequently no dismantling is necessary in welding with the outfit. This is an advantage and of much importance in case of repairs by welding to parts of heavy machines. No pre-heating being necessary, considerable time and money is thereby saved, and it is also important because there is no distortion of metal. The welding outfit has no instruments, no rheostats, no circuit breakers or other complicated means and expensive equipment to get out of order; nor does it have any revolving parts, the maker states. All that is necessary, after having made the proper connections to the power line, is to throw a switch, which is part of the welding outfit, and it is ready to perform its work. With the outfit a long and steady arc may be drawn, which insures a durable and accurate operation and affords great ease to the operator, thereby increasing the amount of work an operator can turn out in a given length of time.

The outfit is installed in a weather-proof case which is equipped with means for moving the outfit about from place to place and for use in connection with its transportation by overhead methods. The floor space taken up by this welding outfit is but 18 in. by 32 in. (45.7 cm. by 8 cm.).

## Mica-Top Standard Fuse Plug

A standard mica-top fuse plug with Edison base in sizes of 3, 6, 10, 12, 15, 20, 25 and 30 amp. is now being manufactured by the Merrill Manufacturing Company, 50 State Street, Boston,



CROSS-SECTIONAL VIEW SHOWING SECURE CONNECTIONS OF FUSIBLE STRIP

Mass. It uses a very high grade of porcelain core, the maker states, and has a brass screw shell and bottom contact as well as a brass top containing the mica window.

As may be seen in the accompanying cross-sectional view of the plug, one section of the fusible strip is soldered to the screw shell and passes into the center of the plug through a cut in the porcelain. The bottom contact passes up through a hole in the porcelain core, and to it is firmly attached the lower section of the fusible element. Soldering the two sections of the fusible elements completes the fuse circuit.

## Combined Air Compressor, Grinder and Buffer

A grinding wheel, a buffer and an air compressor, all driven by a single electric motor, is a combination now being marketed by the LeBron Electric Works of Omaha, Neb. Supplementing the compressor is a garage air tank for 150 lb. (10.5 kg. per sq.cm.) working pressure and measuring 16 in. by 48 in. (40 cm. by 120 cm.).

## NOTES ON RECENT APPLIANCES

### Violet-Ray Machine

The Charles A. Branston Company of 41 Ellicott Square, Buffalo, N. Y., is making six models of the Branston violet-ray high-frequency generator.

### Series Lighting Circuit Cut-Out

A plug cut-out for series lighting circuits has been developed by the Philadelphia Electrical & Manufacturing Company, 1236 North Thirty-first Street, Philadelphia, Pa.

# *Manufacturers' Activities*

PITTSFIELD G. & E. BONUS.—Two thousand employees of the Pittsfield (Mass.) Works of the General Electric Company received a semi-annual bonus of 5 per cent on the earnings of the plant on July 21. The total amount distributed was between $65,000 and $75,000, those sharing being employees of at least five years' standing. The amount distributed was slightly below that shared in January, but the number of employees participating was somewhat larger.

SURPLUS GOVERNMENT ELECTRICAL EQUIPMENT.—There is now available for sale by the Ordnance Department, Bridgeport (Conn.) District Salvage Board, the following electrical equipment: 367 ft. of ¼-in. and 126 ft. of 1-in. bus structure copper; twenty-five 100-amp., 250-volt cut-outs; 2500 200-watt key sockets, shades and shade holders; 142 12-in. globe reflectors; six 5-hp., seven 20-hp. and four 7½-hp. starting rheostats; one four truck capacity 60-30-amp. battery-charging switchboard; one eighteen-panel 3000-kw. power switchboard; four 300-hp., 440-volt motors and four sets of push-button-type controllers. In addition, there are a number of hydraulic pumps, an electrically driven centrifugal air compressor, blowers, mechanical stokers and oil-fuel storage tanks.

OHIO ELECTRIC LIGHT CONVENTION EXHIBITORS.—The following had exhibits at the Ohio Electric Light Association convention at Cedar Point, Ohio, July 15 to 18: Edison Electric Appliance Company, Holophane Glass Company, Hubbard & Company, Bailey Meter Company, Jeffrey-De Witt Insulator Company, National Lamp Works, Bristol Company, George Cutter Company, Ludwig Hommel Company, representing the Sangamo Electric Company; Federal Sign System (Electric), Eureka Vacuum Cleaner Company, Duncan Electric Manufacturing Company, Enner Electric Company, Pittsburgh Piping & Equipment Company, Erner & Hopkins Company, representing Pittsburgh Gage & Supply Company; Safety Meter Box Company, Railway & Industrial Engineering Company, Westinghouse Electric & Manufacturing Company, United Electric Company, Ohio Brass Company, Delta Star Electric Company, F. Bissell Company, General Electric Company, Hurley Machine Company, Electric Vacuum Cleaner Company, Inc., Western Electric Company, Stroud Michael Company (Laundryette Manufacturing Company), Apex Electric Manufacturing Company, Square D Company, Hoover Suction Sweeper Company, Naugle Pole & Tie Company, Wadsworth Electric Manufacturing Company.

THE JEWELL ELECTRIC INSTRUMENT COMPANY of Chicago has now completed its sales organization, which for the past two years it has been building on the policy of concentrating sales work with representatives in the larger cities and electrical manufacturing centers in the United States. This sales organization is organized as follows: Frederick Rall, 19 Park Place, New York City, covers the State of New York, including New York City and adjacent territory; George E. Linton covers Boston territory with offices at 10 High Street, that city; Benjamin B. Baseler, 1716 Sansom Street, Philadelphia, covers Philadelphia and eastern Pennsylvania; western Pennsylvania is covered by the Superior Engineering Company, Jenkins Arcade, Pittsburgh; H. L. Porter, 1202 Illuminating Building, Cleveland, covers that city and northern Ohio; Missouri is covered by C. B. Fall Company, with offices in the Railway Exchange Building, St. Louis; Minnesota is covered by W. F. Uhl, with offices at 505 First National Bank Building, Minneapolis; the More Electric Company covers Colorado, its offices being in the Gas & Electric Building, Denver; L. Brandenberger, Walker Bank Building, Salt Lake City, covers Utah; the Nixon-Kimmel Company, Lincoln and Main Streets, Spokane, covers Spokane and eastern Washington; the Burton R. Stare Company covers western Washington and Oregon, with offices at 325 Yesler Way, Seattle; C. F. Henderson, Call Building, San Francisco, covers San Francisco and northern California; the C. E. Thomas Company, 625 Washington Building, covers southern California, including Los Angeles, its offices being in that city. With the exception of the Filer-Smith Machinery Company, in Winnipeg, which covers Winnipeg and western Canada, and the Tokiwa Company, of Tokyo, Japan, in the Orient, all foreign representation and export business is handled by Frank E. Watts, Inc., 50 Church Street, New York City.

G.-E.-TRUMBULL RELATIONS. — The Trumbull Electric Manufacturing Company, Plainville, Conn., has issued the following statement regarding its recent arrangement with the General Electric Company: "The Trumbull Electric Manufacturing Company announces that the General Electric Company has acquired a financial interest in the Trumbull company, which, however, entails no change whatever in the present management or personnel of the company. It will be the policy of the company to sell its material through the same distributers as in the past and on the same basis as to terms, price and service. The business of the Trumbull Electric Manufacturing Company will be carried on in the future exactly as in the past in every particular. Work has been started on a new factory for the manufacturing of safety switches which will increase the floor space of the plant about 33⅓ per cent. This addition was made necessary by the rapidly growing demand for its safety switches, and the entire new building will be devoted to the production of this one line."

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THE HESS-BRIGHT MANUFACTURING COMPANY, Front and Erie Streets, Philadelphia, has taken bids for a two-story addition, 43 ft. by 105 ft., for its ball-bearing factory.

THE SIERRA ELECTRIC COMPANY, San Francisco, Cal., has been appointed Pacific Coast distributer for the Chicago Solder Company, maker of Kester self-fluxing wire solder. Both acid-core and rosin-core solder will be carried in stock.

THE CENTRAL ELECTRIC COMPANY of Chicago has recently issued price list 39-A, which applies to the company's general catalog No. 39 and is unique in the fact that it carries, along with the prices in that catalog, addenda pages listing new or redesigned devices that have not been previously included.

F. N. COOLEY has been promoted from assistant sales manager to sales manager of the Seattle office of the Western Electric Company. Mr. Cooley first became associated with the company in 1912 as lamp salesman at San Francisco. Two years later he became supply specialist at Seattle, a little later becoming assistant manager there.

THE CHICAGO PNEUMATIC TOOL COMPANY announces the appointment of L. C. Sprague, formerly district manager of sales at New York, as manager of Western railroad sales. Nelson B. Gatch, formerly district manager of sales at Chicago, has been appointed district manager of sales at New York, succeeding Mr. Sprague. Announcement of Mr. Gatch's successor at Chicago will be made later.

BLAW-KNOX COMPANY, Pittsburgh, Pa., announces the opening of an office in the Little Building, Boylston and Tremont Streets, Boston, Mass., and in the Owen Building, Detroit, Mich. A. W. Ransome, formerly of the New York office, assumes the duties of New England manager. H. J. Desson has been transferred from the Pittsburgh office to Detroit to assume the duties of manager of the Michigan district.

THE SCHIEFER ELECTRIC COMPANY, 312 E. & B. Building, Rochester, N. Y., is the new name for Henry J. Schiefer & Company. Through an error in the July 5 issue of the ELECTRICAL WORLD it was stated that this company was capitalized at $75,000 and proposes to manufacture electrical equipment. H. J. Schiefer, Jr., writes that the new company is capitalized at $35,000 to carry on the business of the old company, which is a selling organization only. The company represents in the State of New York in the territory west of Albany the following concerns exclusively, it states: Delta Star Electric Company, Sangamo Electric Company, G. & W. Electric Specialty Company, Moloney Electric Company and Taylor Instrument Companies. It has also a local agency for the Western Electric Company.

THE GENERAL ELECTRIC COMPANY, Harrison, N. J., has filed plans for a two-story brick building in East Orange to cost about $40,000.

THE CHICAGO PNEUMATIC TOOL COMPANY announces the removal of the Minneapolis office from the Metropolitan Bank Building to Fifth Avenue and Fifth Street South.

THE WAGNER ELECTRIC MANUFACTURING COMPANY of St Louis announces the removal as of Aug. 1 of its Philadelphia office, service station and warehouse to 1632-1634 Sansom Street.

J. J. BROWN, formerly vice-president and general manager, has been elected president of the Wheeler Condenser & Engineering Company, succeeding Charles W. Wheeler, recently deceased. H. S. Brown of Boston was elected vice-president. No other changes were made in the officers. H. S. Brown has been associated with the Power Specialty Company, 111 Broadway, New York City, for the past fifteen years, the greater part of the time as New England manager for that company. During the war he was active in the company's government work, with headquarters at Washington and Philadelphia. He is also president of the Brown-Ferries Company of Philadelphia. The business of the Wheeler Condenser company has more than quadrupled during the last ten years under the management of J. J. Brown, and the manufacturing capacity of the plant has been correspondingly increased. One important addition has been the construction of a large tube mill for the manufacture of seamless drawn tubing of brass, copper and special mixture. In this mill the record output of nearly 1,000,000 lb. of condenser tubing in one month was recently made. This tubing is not only used in Wheeler condensers, evaporators, reboilers, etc., but it is also made in large quantities to customers specifications for American trade and for exporting. At this writing, in the condenser department sixteen condensers of approximately 60,000 sq.ft. cooling surface are being made.

J. J. BROWN

THE LEEDS & NORTHRUP COMPANY, Philadelphia, announces that its factory will be closed from Aug. 2 to 16 inclusive. During that period practically the entire force will take its vacation and all production work will be stopped. The company extends a cordial invitation to any of its friends passing through Philadelphia during the summer to inspect the factory.

RATHBONE SARD ELECTRIC COMPANY, Inc., Albany, N. Y., has increased the number of its sales offices and has changed its plan of distribution in that it intends to carry stock of electric ranges in the following cities: Milwaukee, Wis.; Oklahoma City, Okla.; Atlanta, Ga.; San Francisco, Cal.; Dallas, Tex.; Philadelphia, Pa.; Albany, N. Y.; Detroit, Mich.; Chicago, Ill.; Portland, Ore.; Los Angeles, Cal.; New York City; Boston, Mass.; Aurora, N. Y., and Salt Lake City, Utah. Manufacturing arrangements have been changed to include manufacturing of ranges at the Western plant at Aurora, Ill., as well as at Albany, N. Y. Clyde A. Flint has been sales manager of the company since the first of the year.

THE STANDARD ELECTRIC TOOL COMPANY, Cincinnati, Ohio, suffered slight damage by fire recently. No let-up in manufacturing operations resulted.

THE AMERICAN RADIO & RESEARCH CORPORATION, Medford, Mass., will erect a factory three stories and basement, 24 ft. by 72 ft., and two stories, 20 ft. by 36 ft., at a cost of about $250,000.

THE TRENTON ELECTRIC & CONDUIT COMPANY has completed plans for the construction of two new one-story additions to its plant at 1 to 3 Tyler Street. The structures will cost about $10,000.

THE J. LEE NICHOLSON COMPANY, accountants and industrial engineers, announce that they have opened a permanent office in the Harris Trust Building of Chicago, from which office the regular practice of the firm will be conducted.

DR. EDGAR KIDWELL, M. E., formerly Pacific Coast manager of the Babcock & Wilcox Company, New York, has been elected general manager of the Kidwell Boiler & Engineering Company, organized at Milwaukee, Wis., with a capital stock of $1,000,000, to manufacture high-pressure water-tube boilers of his own design.

THE TRUMP MANUFACTURING COMPANY, of Springfield, Ohio, manufacturer of water-power machinery, announces that R. A. Burford, of Atlanta, Ga., has been appointed general representative of the company for the sale of hydraulic turbines in Georgia and North Carolina. Mr. Burford's office is in the Forsyth Building, Atlanta.

THE AMERICAN PRECISION WORKS, 135 Cedar Street, New York City, plan to remove to some city near New York, probably Newark, where they will increase their manufacturing schedule and take up the production of instruments and apparatus for other industrial purposes, particularly for airplanes, airships, automobiles, etc. K. G. Frank is president.

F. D. LAWRENCE, of the F. D. Lawrence Electric Company, entertained field salesmen of his company recently at a dinner at the Gibson House, Cincinnati, and explained to them a certain new household electrical apparatus which the company expects to offer in the market soon. The company proposes to cover Kentucky and the southern half of Ohio in its campaign.

CHARLES H. HUBBELL, formerly secretary and treasurer Texas Power & Light Company and later federal tax consultant of a large Cleveland bank, and Douglas S. Meaden, formerly statistician of the Illinois Public Utilities Commission, announce the opening of offices at 306 Hickox Building, Cleveland, Ohio. They will give their personal attention to tax consulting and accounting engagements.

THE MONTGOMERY PORCELAIN PRODUCTS COMPANY, a newly organized concern which will manufacture the porcelain parts for electric light fixtures and spark plugs, has broken ground for a new factory at Franklin, Ohio. The company hopes to be ready to begin operations in September. Those who are interested in the concern are E. T. Montgomery, Frank DuBois, Tunis G. DuBois and Aaron DuBois.

THE ELECTRIC FURNACE COMPANY, Alliance, Ohio, has installed two electric furnaces at the Capital Brass Works, Detroit, Mich., with capacities of 1500 lb. each and ratings of 1500 kw. In addition to this an identical furnace has been purchased by the Buick Motor Company, Flint, Mich. The Akron Bronze & Aluminum Company, Akron, Ohio, has installed a 50-kw. furnace with 300 lb. to 500 lb. capacity. These furnaces are for melting red and yellow brass, gunmetal and phosphor bronze.

## Foreign Trade Notes

FRENCH INSULATOR FACTORY RESUMES.—Etablissement Charbonneaux et Cie., glass manufacturers at Rheims, on April 25 announced that they had restored to operation one oven for the manufacture of glass electrical insulators. This concern expected, if sufficient supplies of coal should be received, to be able to put a second oven in operation by Aug. 1 and a third about October.

ROTARY SWITCH NOW MADE IN ENGLAND.—For the first time the manufacture of a rotary switch for use on radiators, electric cooking devices and other appliances, showing when the current is on and off, has been undertaken in England. Previously all these switches were imported exclusively from the United States. The Tauk Manufacturing Company, Ltd., of London is now manufacturing a rotary switch, and owing to the import restrictions up to Sept. 1, is making every effort to absorb as far as possible the British market for these switches.

ENGLISH WIRE AGREEMENT. — A new agreement has been signed between the National Electrical Contractors' Trades Association, Ltd., of England, and the British Cable Makers' Association, which agreement is compulsory on all members of both associations and binds the contracting members to buying rubber insulated cables from CMA members exclusively, subject to certain safeguarding provisions. The contractors, of course, receive a differential. This naturally prohibits the sale of American rubber-covered wire to the members of the British Contractors' Association.

STONE & WEBSTER IN FRANCE.—Stone & Webster are establishing a French company—Société Stone et Webster—with headquarters in Paris. Stone & Webster designed and built, during the war, the ordnance base depot of the American Expeditionary Forces. This base depot consisted of 65 shops and warehouses at different points in France. A number of the firm's engineers and constructors engaged on this work remained abroad after the signing of the armistice to study conditions there with a view of maintaining a permanent organization in Europe. As a result of this study and experience gained in doing work for the American Expeditionary Forces, the firm has decided to establish the Société Stone et Webster in Paris, with facilities for making complete investigations and reports and to execute general engineering and construction work along the lines they have always followed in the United States.

BRITISH SIEMENS AFTER FOREIGN TRADE.—Siemens Brothers & Company, Ltd., of England, one of the largest English electrical manufacturing houses, which during the war passed from under German control to British control, was before the war, according to the annual report of the chairman of the company, too insular in its policies. Now, it is stated, as a purely British concern, the company aspires to a substantial share of foreign trade, and in this connection last year it sent on a tour around the world two representatives of long experience, whose job was principally to make it plain that the ownership of Siemens Brothers and of the controlled company, the Dynamo Company, was now entirely in English hands. These representatives went to South America, the Cape, India, Singapore and China, and when the report was written were in Japan, whence they expected to go to Australia and New Zealand, returning to Great Britain by the United States and Canada. It is stated in the report that in pursuance of this larger world policy the company has recently negotiated and completed an agreement with a very important agency which will now act as its agents in China for the majority of its products and those of the Dynamo Company.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Mario Rojas Bazon, Calle Geronimo Cortes, No. 751, Alta Cordoba, Argentina, S. A., head of the traffic department of the Cordoba division, desires an agency for Argentina of American-made electrical apparatus.

A mechanical engineer (No. 29,945), graduate of an American university, will be in America to secure commission or consignment contracts for sale in Belgium of electrical material and supplies and electric furnaces.

A company in India (No. 29,967) desires to purchase complete paint manufacturing machinery with output of 10 tons per day. Electric motors should be supplied with larger machines. Quotations should be given c. i. f. Indian port. Payment in the United States against documents.

The Trans-Oceanic Commercial Corporation, 27 William Street, New York City, the export subsidiary of the U. S. Food Products Corporation, announces that it is sending the first direct steamer from New York to Jugoslavia and that it is prepared to aid in financing shipments. Among the lines which are particularly wanted, it is stated, are electrical goods.

## Trade Publications

SWING SAW.—A motor-driven swing saw is illustrated in a leaflet published by the manufacturer, the Reno-Kaether Electric Company, Cincinnati, Ohio. It is entitled "The 'Get There' Swing Saw."

COMPENSATOR. — Illustrations showing the construction and uses of the E. C. & E. automatic compensator are embodied in a folder put out by the Electric Controller & Equipment Company, Cleveland, Ohio.

ELECTRIC CLEANER. — The Frantz Premier Company, Cleveland, Ohio, has issued a folder describing the advantages of the Frantz Premier Electric Cleaner. It describes the many features of the machine.

UNDERFEED STOKERS.—The operation and construction of the Riley two-speed gear box are fully described in a folder prepared by the Sanford Riley Stoker Company, Worcester, Mass., under the title "Full Control."

STORAGE BATTERY.—"The Fourteen Points" is the subject of a folder and other booklets produced to describe the Marko Storage Battery, manufactured by Paul M. Marko & Company, 1402-1412 Atlantic Avenue, Brooklyn, N. Y.

ELECTRICAL SUPPLIES.—In catalog No. 39 are listed electrical supplies of every nature manufactured by the Central Electric Company, 316-326 South Wells Street, Chicago. The catalog gives price list and list of new and redesigned devices.

ACCIDENT PREVENTION.—A list of appliances inspected for accident hazard has been issued by the National Board of Fire Underwriters, 207 East Ohio Street, Chicago. This list gives electrical and mechanical apparatus tested and also automobile appliances.

## New Incorporations

THE PERRY ELECTRIC COMPANY of Hartford, Conn., has been incorporated with a capital stock of $20,000 by George W. Perry, Ernest C. Perry and S. J. Perry.

THE NAPIER ELECTRIC COMPANY of Boone, Iowa, has been incorporated with a capital stock of $10,000. The officers are: S. A. Walker, president, and W. A. Gillette, secretary.

THE ELECTRIC EQUIPMENT COMPANY of Asheboro, N. C., has been incorporated with a capital stock of $5000 by Leo Barker, Carl Kivett of Asheboro and H. T. Long of Charlotte.

THE INTERNATIONAL INCANDESCENT LAMP WORKS of New York, N. Y., have been incorporated with a capital stock of $25,000 by C. Shickering, I. Goldberg and C. F. Lyngass, Great Kills, S. I., N. Y.

THE COOK MANUFACTURING COMPANY of Charlotte, N. C., has been incorporated with a capital stock of $50,000 to manufacture and deal in electrical appliances, etc. The incorporators are W. J. Cook, J. B. Kerr and A. E. Cohen.

THE ELECTRICAL SUPPLY COMPANY of Kingstree, S. C., has been incorporated with a capital stock of $1,500. The officers are: George A. McElveen, president; E. C. Burgess, vice-president, and R. M. Heise, secretary and treasurer.

THE TRIANGLE ELECTRIC SALES COMPANY of Dayton, Ohio, has been incorporated by L. H. Smith, H. L. Shaffer and others. The company proposes to deal in electrical supplies, etc. The offices of the company are in the Reibold Building.

THE LIBERTY (ME.) LIGHT & POWER COMPANY has been organized with a capital stock of $5,000 to generate and distribute electricity for lamps, heaters and motors in the town of Liberty. H. W. Maitherson is president and J. P. Sanford clerk and treasurer, both of Liberty.

THE WHEELER BATTERY COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $2,000,000 to do a general engineering and contracting business. The incorporators are Samuel C. Wood, Arthur M. Brody of Chicago, Ill., and L. B. Phillips, Delaware.

## New England States

RUTLAND, VT.—The Rutland Railway, Light & Power Company is contemplating the construction of a large hydroelectric power plant on East Creek, between the mill village dam and Mendon.

SOUTHWICK, MASS.—The town of Southwick has voted to purchase electricity from the municipal electric plant in Westfield.

VALLEY FALLS, R. I.—The local repair shops of the New York, New Haven & Hartford Railroad Company were destroyed by fire on July 26, causing a loss of about $500,000.

MYSTIC, CONN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 25 for construction of United States post office, including electric work, plumbing, heating, etc.

NEW HAVEN, CONN.—A petition has been presented to the Board of Aldermen for an extension of the ornamental lighting system from the junction of Congress and Washington Avenues to Howard Avenue.

WALLINGFORD, CONN.—Plans and specifications are being prepared for the installation of an additional 250-hp. Porcupine boiler purchased for the municipal electric light plant nearly two years ago. Contract for piping has not yet been awarded. The installation, piping, etc., will cost approximately $13,000. Al L. Pierce is superintendent and electrical engineer.

## Middle Atlantic States

ALDEN, N. Y.—The Village Board has appointed a committee to make investigations and secure estimates of the cost of a water-power development and installation of a municipal electric lighting system. The cost is placed at about $100,000. W. B. Snyder, J. Simme and I. N. Chase are members of the board. An engineer has not yet been engaged.

ATTICA, N. Y.—At a special election held lately the proposal to sell the village electric light plant to the Genesee Light & Power Company for $12,500 was carried. The Board of Trustees was also authorized to give the company a franchise to furnish the village with Niagara power for the local system.

BINGHAMTON, N. Y.—Plans are under consideration by the Binghamton Light, Heat & Power Company for increasing the output of its power house at Willow Point, at a cost of about $200,000. A 3000-kw. turbine and condenser, it is understood, will be installed at once, and a 5000-kw. turbine and condenser later on.

MEDINA, N. Y.—The Western New York Utilities Company is extending its electric transmission line from Middleport to Barker, a distance of 13 miles.

JERSEY CITY, N. J.—Plans have been filed by the Eastern States Refrigerating Company, 147 East Sixteenth Street, for the erection of a seven-story addition to its plant on Fifteenth Street, to cost about $125,000.

PATERSON, N. J.—Plans are being considered by business men on Main Street for the installation of a new ornamental lighting system along the thoroughfare. Electrical service is furnished by the Public Serivce Electric Company.

TRENTON, N. J.—Plans have been completed by the Trenton Electric & Conduit Company for the construction of two additions to its plant, to cost about $10,000.

CATASAUQUA, PA.—An ordinance providing for an issue of $50,000 in bonds for the construction of a municipal electric light and power plant is under consideration by the City Council.

HARRISBURG, PA.—The Packard Motor Company, 317 North Broad Street, Philadelphia, is planning to install a complete repair shop in connection with the proposed building to be erected on Cameron Street, near Mulberry Street, to cost about $100,000.

LOGANVILLE, PA.—The installation of an electric lighting system in Loganville is under consideration. Electricity to operate the proposed system may be obtained from the Glen Rock (Pa.) Electric Light & Power Company, to be taken from the transmission line, which is to extend from York to Stewartstown, on which work will soon be started.

MIDDLETOWN, PA.—Plans are being considered by the War Department, Washington, D. C., for the construction of a permanent machine and repair shop for air-craft work at the aviation station at Middletown.

# *Construction*

**News of Projects, Plans, Bids and Contracts. Notes on Work Under Way**

PITTSBURGH, PA.—Ground has been broken by the Pittsburgh Model Engine Company for the construction of its proposed new plant on Lexington Avenue, near McPherson Street, to cost about $200,000.

SHENANDOAH, PA.—Bids will be received at the office of the Water Commission of the borough of Shenandoah until Aug. 19 for improvements to waterworks system, including furnishing and installing two centrifugal pumps of 2,000,000 gal. daily capacity each, with motors, and one deep-well pump of 200 gal. per minute capacity, with motor, pumping stations, transformer house, transformers, transmission line, switchboard, piping, ditching, valves, etc. Gannett, Seelye & Fleming of Harrisburg are engineers.

SALISBURY, MD.—Plans, it is reported, are under consideration by manufacturers on the Eastern Shore of Maryland for the construction of a fast electric railway from Salisbury to Tolchester Beach, a distance of about 75 miles. H. H. Messenger, of Federalsburg, is interested.

SISTERSVILLE, W. VA.—The power plant of the West Virginia Power Company, successor to the Sistersville Electric Light & Power Company, will be moved from Sistersville to Paden Park early next year.

WIERTON, W. VA.—Contracts have been awarded by the Wierton Steel Company to the Westinghouse Electric & Manufacturing Company of Pittsburgh, Pa., for electrical machinery and equipment for its new steel works, to cost about $1,000,000.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 5 for lamp standards for various buildings.

WASHINGTON, D. C.—Bids will be received by the Machinery and Engineering Materials Division, Munitions Building, Washington, D. C., until Aug. 8, under circular 16, for furnishing 10 miles special submarine cable, intermediate type, No. 44. For further information address the above office at room 3736.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval station supplies as follows: Until Aug. 5, South Charleston, S. C., Schedule 4236—three transformers. Philadelphia, Pa., Schedule 4250—3000 ft. soft-copper cable. Portsmouth, Schedule 4233—ten motor controllers. Alexandria, Va., Schedule 4248—1000 ft. single-conductor cable. Until Aug. 12, South Brooklyn, N. Y., Schedule 4241—50 four-way composition branch boxes, 20 three-way armored cables, 50 telephone plugs, 50 pounds pressed-plate mica, 400 telephone mouthpieces, 10,000 socket bushings and midget push buttons. Brooklyn, N. Y., Schedule 4245—Miscellaneous ignition wire. Until Aug. 15, Washington, D. C., Schedule 4258—50,000 ft. single-conductor cable on reels. Application for proposal blanks should designate the schedule desired by number.

## North Central States

DETROIT, MICH.—Plans are being prepared by the Fisher Body Company, Piquette and Oakland Avenues, for an addition to its plant, to cost about $500,000.

HIGHLAND PARK, MICH.—Preliminary plans are being prepared for the proposed new plant of the Maxwell Motors, Inc., to cost, including equipment, about $5,000,000. The proposed plant will be located near its present works. Smith, Hinchman & Gryllis, Washington, Arcade, are architects.

LANSING, MICH.—Plans have been prepared by O. E. Eckhart, architect, City Hall, for extension to the municipal electric light plant, to cost about $300,000.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Aug. 8 for double-braided, rubber-covered wire for the division of light and heat.

COLUMBUS, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 22, for furniture, lighting fixtures, etc., in the United States post office and court house, Columbus. For details see Searchlight Section.

DAYTON, OHIO.—Plans have been prepared by the Dayton Engineering Laboratories Company for extensions to its plant, to cost about $250,000.

HAMILTON, OHIO.—The City Council is considering calling an election to submit to the voters the proposal to issue $600,000 in bonds for a new municipal electric plant.

LIMA, OHIO.—At an election to be held Aug. 12 the proposal to issue $120,000 in bonds for the construction of a municipal electric light plant will be submitted to the voters.

MARYSVILLE, OHIO.—The Council is considering the installation of cluster lamps in the business section of the town.

OXFORD, OHIO.—The town of Oxford has voted to sell its electric lighting plant. The proceeds of the sale of the plant are to be used for rehabilitating and equipping for electrical operation the municipal waterworks system. The Ohio Gas & Electric Company of Middletown has purchased the municipal electric plant and will erect a transmission line to Oxford and supply electricity here under a franchise granted by the town.

INDIANAPOLIS, IND.—The Nordyke & Marmon Company has taken out a permit for the erection of an assembly room for motors, 802 ft. by 100 ft., to cost about $90,000. This is in addition to the proposed factory additions that are to cost about $350,000.

SOUTH MILFORD, IND.—The installation of an electric lighting system in South Milford is under consideration.

BLUE ISLAND, ILL.—The American Wire Fabrics Company, 208 South La Salle Street, Chicago, it is reported, will soon ask for bids for the construction of its proposed plant at Blue Island, to cost about $1,000,000.

CHICAGO, ILL.—Plans are under consideration by Albert Pick & Company, 212 West Randolph Street, for the erection of a five-story addition to its plant, to cost about $400,000. The company manufactures cooking apparatus and metal novelties.

CHICAGO, ILL.—Plans have been prepared by the Seng Company of Chicago for the erection of a factory at the corner of Diversy Boulevard and North Crawford Avenue. The cost of the first unit will be $750,000, and of the entire works about $1,500,000. The company manufactures furniture hardware.

DES PLAINES, ILL.—The Benjamin Electric Company, it is reported, has awarded contracts for the construction of an addition to its works, to cost about $180,000.

PEORIA, ILL.—The Peoria Railway Company is contemplating improvements to its system involving an expenditure of about $100,000.

SPRINGFIELD, ILL.—The City Commissioners are considering an issue of $400,000 in bonds for extensions to the municipal electric light and power plant. Willis J. Spaulding is commissioner of public property.

CHETEK, WIS.—An election will soon be held to submit to the voters the proposal to purchase the distribution system of the Chetek Light & Power Company, at $9,000.

GRAND RAPIDS, WIS.—The Consolidated Water Power & Paper is planning to erect a new electric transmission line between Grand Rapids and Stevens Point, at a cost of about $50,000.

ST. JAMES, MINN.—Bonds to the amount of $20,000 have been authorized by the City Council for improvements to the municipal electric light plant.

DAVENPORT, IOWA.—The White Lily Washing Machine Company is building an addition to its plant to cost about $165,000.

ELDRIDGE, IOWA.—The City Council has decided to secure electricity from the plant at Davenport. The cost is estimated at $6,000.

FERGUSON, IOWA.—An election will be called to submit to the voters the proposal to establish a municipal electric light plant in Ferguson.

IOWA CITY, IOWA.—All bids submitted for construction of power house for the proposed municipal electric light plant have been rejected. New bids will soon be asked for. The contract for equipment, including engine, generator, switchboard, fire-tube boilers, transformers, etc, has been awarded to D. G. Fisher & Company of Davenport at $36,000. The Henningsen Engineering Company, National Bank Building, Omaha, Neb., is architect and engineer.

SIOUX CITY, IOWA.—The City Council is contemplating reorganizing the telephone system and will build an entire new plant. The cost is estimated at about $1,000,000. Paul J. Wills is city clerk.

KANSAS CITY, MO.—The moving-picture producers and film distributers have decided to erect an exchange and office building in Kansas City, to cost about $500,000. The proposed building will be twelve stories high, 115 ft. by 50 ft. The cost of the electric elevators and electric lighting installation is estimated at $35,000 and that of the steam heating plant at $14,000.

ST. JOSEPH, MO.—Work has been started on improvements to the plant of the St. Joseph Railway, Light, Heat & Power Company, which will include the installation of a 12,500-kva. turbine complete with surface condensers and auxiliary switchboard equipment. A complete new arrangement of boiler-feed pumps and accessories will be made. An oil-burning system will be installed, which will do away with the use of coal entirely. The cost of the improvements is estimated at $1,000,000.

ST. LOUIS, MO.—The contract for the construction of the proposed power house for the St. Louis Manufacturing Company has been awarded to the A. H. Haeseler Building & Construction Company, Wainwright Building. The building will be 96 ft. by 150 ft. and will cost about $125,000.

BERESFORD, S. D.—Bids will be received at the office of the city auditor, Beresford, until Aug. 8 for construction of an electric light plant as follows: (1) Brick and tile building; (2) equipment, including two 120-hp. Diesel or semi-Diesel type oil engines, directly connected to two 100-kva. generators, switchboard, constant-current transformers, etc.; (3) pole line, including furnishing and erecting poles, wires, transformers, etc. Copies may be obtained at the office of Earle D. Jackson, engineer, Capital Bank Building, St. Paul, Minn., for which the sum of $1.50 is asked for each part, or $4 for all three parts, to cover the cost of printing.

GREGORY, S. D.—At a special election held recently bonds to the amount of $122,000 were voted for improvements to the municipal electric light, waterworks and sewer systems.

MINDEN, NEB.—An election will soon be held to vote on the proposal to issue $35,000 in bonds for improvements to the municipal electric light plant.

OMAHA, NEB.—Plans have been prepared by John Latenser & Sons for the Lord Lister Hospital to be erected by Dr. E. C. Henry, at a cost of about $275,000.

ARLINGTON, KAN.—At an election to be held Aug. 1 the proposal to issue $20,000 in bonds for the installation of an electric lighting system in Arlington will be submitted to the voters.

HUDSON, KAN.—An election will be held to submit to the voters the proposal to issue $15,000 in bonds for the erection of an electric transmission line.

HUTCHINSON, KAN.—Elections are to be held at Arlington, Langdon and Turon to vote on the proposal to issue bonds for the erection of electric transmission lines from Hutchinson.

SHARON SPRINGS, KAN.—Bids will be received by H. C. Wheeler, city clerk, until Aug. 5 for drilling two wells, installing two motor-driven pumps, construction of power house, equipped with one or two oil engines with generators, and 3000 ft. of 4-in. and 6-in. cast-iron pipe. Black & Veatch, Interstate Building, Kansas City, Mo., are engineers.

## Southern States

NASHVILLE, N. C.—Bids will be received by the Board of Commissioners of Nash County, Nashville, N. C., until Aug. 20 for construction and improvements, lighting and heating the Nash County Courthouse. Plans and specifications may be obtained upon deposit of $25. J. B. Boddie is clerk of board of commissioners.

ZEBULON, N. C.—Bids will be received by the Mayor and Commissioners of the town of Zebulon until Aug. 5 for construction of waterworks and sanitary sewers. The waterworks will consist of approximately 4 miles of cast-iron pipe, 6 to 8 in. in diameter; valves, hydrants, pumping station, tower and tank, motor-driven pumps, reservoirs, etc. Plans may be obtained from William M. Piatt, of Durham, engineer. F. E. Bunn is town clerk.

LOCKHART, S. C.—Contract has been awarded by the Lockport Power Company for construction of power house, 35 ft. by 160 ft., to the Hardway Contracting Company of Columbus, Ga. Machinery, it is understood, has been purchased.

PARIS ISLAND, S. C.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., to the Contracting & Engineering Company, Law Building, Newport News, Va., for construction of extension to the local power house. The cost is estimated at $10,385.

ATLANTA, GA.—The Atlanta Ice & Coal Corporation is considering the construction of another cold-storage warehouse, equipped with an ice-making machine of 200 tons daily capacity. The cost is estimated at about $250,000. The company will also erect an office building, at a cost of about $50,000, and make improvements to other Georgia plants. O. W. Deyerle is architect, and Paul Wilcox is chief contractor.

BOWMAN, GA.—The installation of an electric lighting system in Bowman is under consideration.

LA GRANGE, GA.—Bids will be received by the city of LaGrange until Aug. 5 for construction of approximately 4 miles of sewers, disposal plant, 4 miles of water mains, storage reservoir, 2 miles of electric transmission line, one 500-gal.-per-minute filter, and one 500-gal.-per-minute horizontal centrifugal pump directly connected to motor, and furnishing material for same. Plans and specifications may be obtained at the office of C. H. Sargent, city engineer, LaGrange, Herman Horn is clerk and treasurer.

MIAMI, FLA. — Contracts have been placed by the Miami Electric Light & Power Company for new equipments for its plant, costing about $150,000. The power house will be rebuilt to provide space for the new machinery. The cost of the entire work is estimated at $200,000. H. H. Hyman is manager.

CENTERVILLE, TENN.—Bonds to the amount of $15,000 have been voted for the installation of a municipal electric light plant.

KNOXVILLE, TENN. — The William J. Oliver Manufacturing Company is contemplating the construction of a new foundry, to cost about $30,000. An electric furnace will be installed.

DUNCAN, MISS.—At an election to be held Aug. 5 the proposal to issue $12,000 in bonds for installation of an electric light plant and extensions to waterworks system will be submitted to the voters.

LAMBERT, MISS.—Bids will be received at the office of the town clerk, Lambert, Miss., until Aug. 12 for construction of sewers and waterworks. The water plant is to consist of steel tank, 50,000 gal. capacity; concrete reservoir, 50,000 gal capacity, pump, and engine complete. H. D. Glass is town clerk.

LEXINGTON, MISS.—Bids will be received by the Mayor and Board of Aldermen of Lexington until Aug. 7 for furnishing machinery and materials for construction of an electric lighting system. Plans and specifications may be obtained from W. L. Jordan, city clerk, upon deposit of $5. Massena L. Culley of Jackson is consulting engineer.

HENRYETTA, OKLA.—Plans are under consideration by the Henryetta Spelter Company for the erection of a large plant, to cost about $750,000, for which a site of 26 acres has been purchased. The company will have its own electric generating plant, using gas, oil or coal for fuel. O. A. Oesterle of Henryetta is president.

HYDRO, OKLA.—Bonds have been authorized for the purchase of the local electric light plant and ice factory.

BEEVILLE, TEX.—Improvements are contemplated to the local electric light plant.

LULING, TEX.—A petition has been presented to the Board of Commissioners asking that an election be called to vote on the proposal to issue $75,000 in bonds for the construction of a municipal electric light plant and waterworks system in Luling.

## Pacific and Mountain States

PORTLAND, ORE.—The Eagle Flouring Mills Company, it is reported, will build a mill and elevator at the new St. Johns municipal terminal to cost about $1,000,000.

FRESNO, CAL.—Plans are being prepared by the Pacific Telephone & Telegraph Company for extensions to its cable system in the north and east section of the city, to cost about $55,000.

LA JOLLA, CAL.—E. F. Stahle, chairman of transportation of the Chamber of Commerce of La Jolla, has announced that financial arrangements have been made for building an electric street railway at La Jolla. It is proposed to take over the present line of the Bay Shore Railroad Company wnich connects with the Point Loma Electric Railroad at Ocean Beach and extends through Mission Beach, and to build 4½ miles of new line, which is to be operated as an auxiliary of the San Diego Electric Railway Company.

SAN DIEGO, CAL.—The construction of a municipal electric light plant in San Diego is under consideration by the City Council.

SAN PEDRO, CAL.—The Pacific Electric Railway Company is planning to erect a new substation on North Front Street in San Pedro, to cost about $12,000.

WILLOWS, CAL.—As a step toward community ownership of an electric power plant the rice growers of Glenn County have taken an option on a water right near Polk Springs in Tehama County, about 43 miles from Chico, with the intention of building a hydroelectric plant and distributing electricity for lamps and motors. If the report of the engineer is favorable, a company will be organized to build the plant and electric transmission system.

## Canada

CAMROSE, ALTA.—The by-law authorizing the Town Council to make improvements to the municipal electric light plant has been approved by the ratepayers.

VANCOUVER, B. C.—An appropriation of $5,000,000 has been made by the Dominion government for improvements in Vancouver, including the construction of wharves and equipment for same. R. G. Swan of Ottawa, Ont., is engineer.

HALIFAX, N. S.—The Public Utilities Commission has granted the Nova Scotia Tramways & Power Company permission to issue $2,000,000 in notes. The company contemplates extensions and improvements this year to its tramway lines, involving an expenditure of about $1,000,000. The proposed work will include the installation of new equipment in power house, extensions of lines, the purchase of new cars, etc.

NORWOOD, ONT. — Negotiations are under way by the Hydro-Electric Power Commission of Ontario for a right-of-way along the Canadian Pacific Railway, 15 ft. wide, from Norwood to Peterborough, for the erection of its proposed transmission line from Healy Falls.

PEMBROKE, ONT.—Extensions and improvements are contemplated by the Pembroke Electric Light Company.

PETERBOROUGH, ONT.—The Hydro-Electric Power Commission of Ontario is contemplating the construction of an electric radial railway from Peterborough to Kinmount.

ST. RAPHAEL, QUE.—Plans have been completed by Gauvin & Lessard, engineers, 147 Cotê de la Montagne, Que., for a water-power development at St. Raphael for La Corporation Electrique de Montgamy. The engineers, it is reported, would like to receive prices on equipment for proposed plant, including two waterwheels with a rating of 1100 hp. each; head 245 ft. Also for two generators, exciters, switchboards; penstock, 8020 ft. long; one headgate, and construction of three-phase, 55,000-volt transmission line, 16 miles long.

SUTHERLAND, SASK.—Bids will be received by the Department of Public Works, Ottawa, Ont., until Aug. 5 for an automatic lighting plant, fixtures and pole line for the Forest Nursery Station. Plans and specifications may be obtained from the chief architect, Ottawa; clerk of works, Regina, Sask., and caretaker, public building, Saskatoon. R. C. Desorchers is secretary.

## Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Aug. 8 for chain hoist, rolled steel, lamp posts, panelboards, conduit, cable, copper wire, pipe fittings, etc. Blanks and further information relating to this circular (1290) may be obtained at the above office.

PANAMA.—Bids will be received at the office of the purchasing officer, the Panama Canal, Washington, D. C., until Aug. 11 for range indicators, glands, brackets, pig lead, copper cable, pneumatic tires and cables, etc. Blanks and information relating to this circular (1292) may be obtained at the above office.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 29 South La Salle St., Chicago, Ill.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West Fortieth St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. University of Pennsylvania, Philadelphia, Pa.

ARKANSAS UTILITIES ASSOCIATION. Secretary, W. J. Tharp, Little Rock, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, H. T. Edgar, Stone & Webster, Boston, Mass. Annual meeting, New London, Conn., Sept. 16-18.

ASSOCIATION OF MUNICIPAL ELECTRICAL ENGINEERS OF ONTARIO. Secretary, R. A. Clement, 190 University Ave., Toronto, Ont., Can.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa. Annual convention, St. Louis, Mo., Sept. 22-26.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & North Western Railway, Chicago, Ill.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, W. Volkman, Toronto Power Company, 12 Adelaide St., East, Toronto, Ont.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

CONFERENCE CLUB. Secretary, Sullivan W. Jones, 110 West 40th St., New York City.

COMMERCIAL SECTION, N. E. L. A. Secretary, Henry Harris, Pittsburgh, Pa.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York City.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 38th St., New York City. Annual meeting, New York City, Oct. 9.

## *Directory of Electrical Associations*

Printed in the First Issue of Each Month

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, Springfield, Ill. Annual convention, Chicago, Ill., Oct. 22 and 23.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention, Chicago, Oct. 20-23.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Annual meeting, Chicago, Sept. 23-26.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria Street, Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

JOVIAN ORDER. Jupiter (president), J. F. Strickland, Dallas, Tex.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Detroit, Mich. Convention, Ottawa Beach, Mich., Aug. 19-21.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary and treasurer, Meyer Barnest, St. Paul, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary, E. S. Meyers, Vicksburg, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 721 Locust St., St. Louis, Mo.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, W. H. Morton, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania Tennessee and Wisconsin. Annual convention, Baltimore, Md., Oct. 6, 1920.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass. Annual meeting, Springfield, Mass., Oct. 13 and 14.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual convention, New London, Conn., Sept. 22, 23, 24.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OKLAHOMA UTILITIES ASSOCIATION. Secretary, H. A. Lane, 611 State National Bank Building, Oklahoma City.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, 618 Mission St., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa. Annual meeting, Bedford Spings, Pa., Sept. 3, 4, 5 and 6.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 4171 Beaufort Avenue, Woodlawn, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York City.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer, O. J. Gronsdahl, Hartford, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga. Annual convention, Asheville, N. C., Sept. 17-19.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex.

TECHNICAL AND HYDROELECTRIC SECTION OF THE N. E. L. A. Secretary, W. C. Anderson, 29 West 39th St., New York City.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Rutland, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.

(Issued July 8, 1919)

1,309,363. ILLUMINATIVE TOOL; Edward J. Meinke, Chicago, Ill. App. filed March 22, 1919.

1,309,364. APPARATUS FOR TRANSMITTING SIGNALS; Wilmer W. Miller, Ardmore, Pa. App. filed May 16, 1916.

1,309,366. MOTOR CONTROL; Niels L. Mortensen, Milwaukee, Wis. App. filed April 16, 1917. Relays limited to response sequentially.

1,309,369. ANSWER-BACK FOR SIGNALING SYSTEM; Charles S. Rhoads, Jr., Indianapolis, Ind. App. filed Feb. 25, 1918.

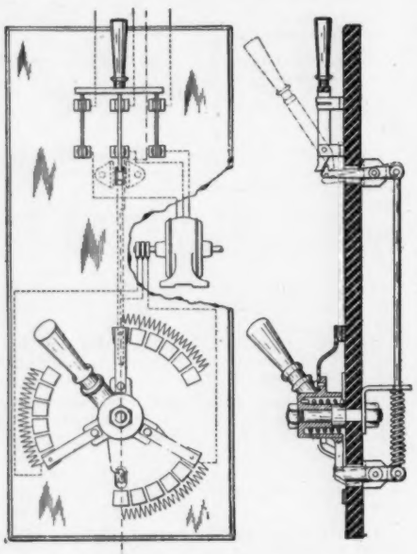
1,309,375. ELECTRIC LAMP STANDARD; Wilton A. Taylor, Meriden, Conn. App. filed Feb. 24, 1919.

1,309,377. BRAKE MECHANISM; Charles R. Underhill, New Haven, Conn. App. filed March 12, 1917.

1,309,400. RADIO-FREQUENCY INTERFERENCE BALANCE; Lloyd Espenschied, Hollis, N. Y. App. filed Oct. 23, 1916.

1,309,406. DINING-TABLE CONNECTOR; John F. Gilchrist, Chicago, Ill. App. filed Aug. 13, 1917.

1,309,413. RECORDING SYSTEM AND APPARATUS; Richard M. Hopkins, Rutherford, N. J. App. filed Dec. 28, 1917.



1,309,797—Motor Controller

1,309,441. OPTICAL SIGNALING APPARATUS; Clyde S. McDowell, United States Navy. App. filed Jan. 7, 1916.

1,309,443. DISTRIBUTION OF ELECTROMOTIVE POWER; George W. Mascord, London, Eng. App. filed Nov. 23, 1912. Excessive amount of current from source of supply avoided.

1,309,459. WIRELESS SIGNALING SYSTEM; John R. Carson, New York, N. Y. App. filed Nov. 10, 1915.

1,309,494. X-RAY SYSTEM; Richard Varley, Englewood, N. J. App. filed March 18, 1915.

1,309,508. CARTRIDGE FUSE; Robert C. Cole, Hartford, Conn. App. filed Jan. 21, 1919. Soldering avoided.

1,309,523. PROCESS OF FORMING ELECTRICAL CONTACTS; William F. Hosford, Oak Park, Ill. App. filed Sept. 24, 1915.

1,309,524. ELECTRICALLY OPERATED RAILWAY SWITCH; James A. Johnson, Stockville, Neb. App. filed Nov. 20, 1915. Energized by train.

1,309,538. WIRELESS SYSTEM; John Mills, Wyoming, N. J. App. filed Oct. 6, 1915.

1,309,539. HEATER FOR MANIFOLD INTAKES; Watt L. Moreland, Los Angeles, Cal. App. filed March 20, 1916. Control of combustible fluid.

1,309,541. LUNCH PAIL; Clarence M. O'Neel, Eagle Creek, Ore. App. filed Dec. 7, 1917.

1,309,561. CONNECTION FOR ELECTRIC BATTERIES; Frederick J. Beaumont, London, Eng. App. filed Oct. 2, 1916.

1,309,569. CALL BOX; Paul Gnifke, Milwaukee, Wis. App. filed July 16, 1917.

# *Record of Electrical Patents*

Notes on United States Patents

(Issued July 15, 1919)

14,685 (reissue). TEMPERATURE-CONTROL SYSTEM; Frank Ahlburg, San Francisco, Cal. App. filed Feb. 19, 1918.

1,309,638. ELECTRIC RIVETING APPARATUS; Frank P. Robert, Amityville, N. Y. App. filed May 9, 1916. Cushioned action; vertically adjustable table.

1,309,640. MOTOR CONTROL; Louis Larsen, Brooklyn, N. Y. App. filed Feb. 3, 1916. Multiphase motor.

1,309,641. ACCELERATING MAGNET; David C. Larson, Yonkers, N. Y. App. filed Aug. 26, 1916. Improved switch-arm action.

1,309,642. REVERSE-PHASE RELAY; David C. Larson, Yonkers, N. Y. App. filed June 23, 1917. Carbon contact, two-three-phase.

1,309,696. ELECTRIC WELDING; Montague H. Roberts, Jersey City, N. J. App. filed Feb. 4, 1919. Atmospheric oxygen excluded.

1,309,697. ELECTRIC BOILER; Ora E. Sarr, Sandusky, Ohio. App. filed April 23, 1918. Large heating element; plates insulated.

1,309,704. THERMIONIC AMPLIFIER; Erwin R. Stoekle, New York, N. Y. App. filed June 13, 1917.

1,309,711. POST-TYPE ARC LAMP; Christian Aaalborg, Wilkinsburg, Pa. App. filed May 4, 1915. Electrodes accessible.

1,309,717. SECTION INSULATOR AND HAND SWITCH; Newton K. Bowman, Canton, Ohio. App. filed April 29, 1918. Fusing of switch blades eliminated.

1,309,720. SIGNAL RECORDER; Herman W. Doughty, Binghamton, N. Y. App. filed Nov. 30, 1914.

1,309,733. SYSTEM OF CONTROL; Rudolf E. Hellmund, Swissvale, Pa. App. filed June 15, 1917. Overheating prevented.

1,309,745. MACHINE TELEGRAPH; Louis M. Potts, Baltimore, Md. App. filed May 1, 1916.

1,309,750. POLARIZED SIGNALING MECHANISM; Daniel S. Wilson, West Somerville, Mass. App. filed May 25, 1917.

1,309,753. MEANS FOR TRANSFORMING MECHANICAL VIBRATIONS INTO ELECTRICAL VIBRATIONS; Lee De Forest, New York, N. Y. App. filed Jan. 22, 1916. Vacuum tube.

1,309,778. RADIO-TELEGRAPH TRANSMITTING SYSTEM; Oscar C. Roos, Allston, Mass. App. filed July 14, 1917.

1,309,797. MOTOR CONTROLLER; Edward I. Deutsch, North Norwood, Ohio. App. filed July 26, 1915. Guards closing of primary circuit.

1,309,799. FLANGED ARTICLE; Edgar C. George, Norwood, Ohio. App. filed Jan. 27, 1915. Used as insulating material.

1,309,802. LIQUID RHEOSTAT; Henry C. Holthoff, Milwaukee, Wis. App. filed July 16, 1917. Electrotype remains horizontal.

1,309,814. INSTANTANEOUS-VOLTAGE-REGULATING MEANS; Edmund O. Schweitzer, Chicago, Ill. App. filed May 9, 1917. Single transformer.

1,309,822. SWITCH; Halfdan A. Steen, Milwaukee, Wis. App. filed Sept. 6, 1910. Remote control.

1,309,840. ELECTRIC SWITCH; Carl Bramming, Chicago, Ill. App. filed May 3, 1917. Single-plunger type.

1,309,845. ELECTRIC VULCANIZER; Oliver C. Dennis, Chicago, Ill. App. filed Nov. 26, 1915. Cut-out and fusible connection.

1,309,870. TROLLEY-WIRE CLAMP; Dorsey G. Winchester, Pruden, Tenn. App. filed Sept. 19, 1918. Simple construction.

1,309,873. ELECTRIC HEATER; Philip F. Apfel, Seattle, Wash. App. filed July 3, 1917. Adaptable.

1,309,881. CIRCUIT CLOSER; Frederick E. Edwards, San Francisco, Cal. App. filed Aug. 6, 1917.

1,309,887. ELECTRIC WIRING TERMINAL; Le Roy M. Fulton, Des Plaines, Ill. App. filed June 19, 1918. Heavy duty.

1,309,895. QUICK-BREAK SWITCH; Knud Knudsen, Plainville, Conn. App. filed Aug. 23, 1918. Single bracket.

1,309,908. AUTOMATIC HEAT-CONTROLLED CUT-OUT; William C. Newell, Portland, Ore. App. filed June 27, 1917. Adaptable.

1,309,913. SPARK-GAP MECHANISM; Charles J. Reed, Glenside, Pa. App. filed Aug. 8, 1917.

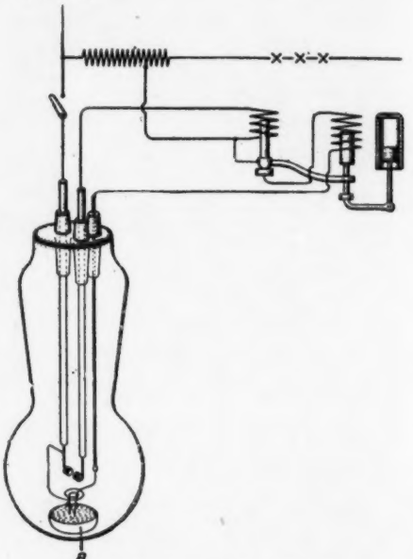
1,309,931. METER-TESTING APPARATUS; Henry J. Blakeslee, West Hartford, Conn. App. filed Nov. 2, 1916.

1,309,947. METHOD OF ELECTRIC WELDING AND APPARATUS FOR USE THEREIN; John G. Kjellgren, Brooklyn, N. Y. App. filed Dec. 14, 1916. High voltage.

1,309,960. TELEGRAPH APPARATUS; Edwin Pope, Quebec, Can. App. filed June 21, 1915.

1,310,011. SUBMARINE SOUND SIGNALING; John Gardner, Fleetwood, Eng. App. filed July 31, 1917.

1,310,061. X-RAY APPARATUS; William D. Krautter, Chicago, Ill. App. filed May 27, 1918.



1,310,067—Inclosed-Arc Device

1,310,040. SYSTEM OF MOTOR CONTROL; John F. Tritle, Schenectady, N. Y. App. filed June 20, 1916. Prevents destructive arcing.

1,310,041. WIRELESS SIGNALING SYSTEM; William C. White, Schenectady, N. Y. App. filed Jan. 18, 1917.

1,310,042. ELECTRICAL APPARATUS; William S. Williams, Pittsfield, Mass. App. filed Dec. 14, 1918. Motor windings retained in position.

1,310,054. PROTECTIVE DEVICE FOR ELECTRICAL APPARATUS; Lewis R. Brown, Pittsfield, Mass. App. filed Dec. 9, 1918. Double protection.

1,310,060. ELECTRIC RESISTANCE FURNACE; Edgar F. Collins, Schenectady, N. Y. App. filed Sept. 21, 1918. Even distribution of heat.

1,310,061. X-RAY APPARATUS; William D. Coolidge, Schenectady, N. Y.

1,310,063. ELECTRICAL APPARATUS; Joseph R. Cummings, Pittsfield, Mass. App. filed Dec. 2, 1918. Exterior housing holds transformer leads in place.

1,310,067. INCLOSED-ARC DEVICE; Philip K. Devers, Jr., Lynn, Mass. App. filed March 6, 1916. Mercury vapor.

1,310,070. ELECTRIC WELDING; Henry Geisenhoner, Schenectady, N. Y. App filed April 26, 1918. Step-by-step progress; current applied intermittently.

1,310,079. ELECTRIC FURNACE; Ingenuin Hechenbleikner, Charlotte, N. C. App. filed March 22, 1919. Electrodes cooled, and supported gas may be introduced in vacuum.